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ERRATUM.

Page 239, second line.

For "Seek to confirm the statement to be very suitable for."
Read "Terms for the acquisition of land being confined to."

LIST OF ILLUSTRATIONS.

Government Printing Works, Pretoria

Plate CXXI

Some Types of Transvaal Tobacco Leaf.
(See Some Notes on Tobacco p. 21.)

Transvaal Agricultural Journal.

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IRRIGATION AND INTER-COLONIAL CO-OPERATION.*

By W. L. Strange, M. Inst. C.E.,

Director of Irrigation.

1. Introductory.

It may be taken for granted that most persons who have lived in South Africa, and that all who have made their homes in the sub-continent, desire her prosperity. The far-seeing leaders of men, who have been and who are still with us, have ever held that that prosperity can best be assured by co-operation which will weld her Colonies into one united whole and fit her to take a prominent place in that still greater combination of varied countries with diverse races, but with one common centre, to which we give the proud title of Empire. The engineer, who, of all professional men, has had the leading share in making the empire possible—by improving communications, by developing even its most distant possessions and by increasing the facilities for civilisation—may well feel that he can help forward the good work in South Africa. Each branch of engineering has its sphere of usefulness and can aid its numerous other branches, so that a bare enumeration of the important matters in which the profession as a whole has played, and will play, a part in ensuring the progress of the empire would take up much space. The author would, therefore, confine himself to that branch of engineering—irrigation—with which he has been connected throughout his professional career. He proposes shortly to describe the necessity that exists for irrigation; how irrigation has been developed in other countries; the material advantages which can be secured by it in South Africa; the objections raised to it and the answers to them; and how it will serve to weld together the dominant races

*Read before the South African Association for the Advancement of Science at their meeting at Kimberley in July, 1906, and reprinted with the Association's permission. [Act. Ed., *T.A.J.*]

in the sub-continent. Thereafter, he will discuss briefly the special utility of each of the main classes of irrigation works, and, finally, will deal with the way in which irrigation can best be developed by inter-colonial co-operation to the mutual advantage of the different Colonies. His experience of South Africa has been limited to three years' service in the Transvaal, but he thinks that the conditions in the other Colonies are sufficiently similar to those which obtain in it as to make general observations applicable to all. He feels that his remarks could not be addressed more fitly to any other Association than that which has for its object the advancement of science in South Africa, nor in any other place than Kimberley where the three principal Colonies of the sub-continent may be said to meet.

2. The Necessity for Irrigation.

In all tropical and sub-tropical countries where the rains are not regular and seasonable, irrigation is found to be a necessity. There is no reason why the case should be different in South Africa where the rainfall on most of the area suitable for occupation by white men is more or less precarious. Even when it is abundant there, a large portion falls in violent storms, of which the resulting flow rapidly runs off the ground and goes to waste, while frequently another large portion falls at unseasonable periods and is evaporated or descends deep into the absorbent soil.

The only certainty the farmer has is that during four months of the year a very small amount of rain falls which is speedily evaporated or absorbed, and for another four months practically none is precipitated. The general conditions are that when water is most wanted it is least available, and that the most valuable crops cannot be grown without artificial watering. During the period of good rainfall the cultivator has, moreover, to contend with special difficulties, such as hailstorms and locusts, which are absent during the rest of the year. So much is he handicapped by these conditions that, in the south-western and central divisions of the Transvaal, a fair crop is expected only once in five years ; in its south-western division many experienced farmers have given up ploughing as a waste of money. It is the opinion of practically all farmers long resident in the Colony that, without irrigation, they cannot be successful with their crops. This is not a newly-formed idea, for, from the time of the earliest settlements, the riparian farms were always considered the most valuable and were occupied first, the non-riparian farms being taken up merely as subsidiary to them for cattle grazing, etc. As evidence that the same value is still attached to water, may be quoted the facts that its availability is always brought forward prominently at all sales of lands possessing it, and that irrigators are most tenacious of their rights to water. As cultivation increases, the existing natural sources of supply will not suffice for it, and this has already proved to be the case on streams where irrigation has been developed to a considerable extent.

3. Irrigation in other Countries.

The following figures will give some idea of the extent of irrigation in other countries :—

		Acres.
India (average about 1901) (State Works)	..	18,588,000
„ „ „ (Private Works)		25,510,000
Total	.. ..	44,098,000
Egypt (1)	.. ..	5,750,000
United States of America (2)	.. ..	7,600,000
Italy (2)	.. ..	4,700,000
Spain (2)	.. ..	2,800,000
France (2)	.. ..	400,000

In India it is comparatively of recent date since the British Government undertook irrigation on a large scale. By 1902-3. Government had expended about £28,500,000 on works for which capital accounts are kept, and were spending at the rate of about £2,000,000 a year on all classes of irrigation. That year the net revenue return on the first-named works was nearly 7 per cent., and the value of the crops matured by their means was estimated at about 88 per cent. of their total cost. The Government of India in 1901 appointed an influential Irrigation Commission to tour all over the empire to ascertain how irrigation could be developed, and this Commission recommended a further capital expenditure of not less than £29,000,000 on new works for the irrigation of 6,500,000 acres. The private works in India consist of wells, small channels and reservoirs.

In Egypt, practically the entire financial position depends upon irrigation. The British engineers employed in its development have raised that country in a comparatively short time from poverty to affluence. It is common knowledge that large works have been constructed there within the last few years. Here again, investigations have recently been carried out for greatly increased irrigation development, both in Egypt and in the Soudan, upon which it is estimated £22,000,000 can be spent (3). The gross yield of the produce from irrigated land in Egypt is estimated at £7 an acre.

In America, irrigation is being extensively developed, principally in the Western States, which, like many parts of South Africa, are arid. This subject there engages the attention of a highly scientific staff, and the result of its work has been to enable the country to export agricultural produce in large amount despite the high cost of labour.

Mr. Hitchcock says (4) :—" There is no one question now before the people of the United States of greater importance than the

(1) "Egyptian Irrigation," by Sir W. Willcocks (Spon, London, 1899).
(2) "Irrigation Engineering," by H. M. Wilson (Wiley, New York, 1903)
(3) Sir William Garstin's Report on the Upper Nile—Cairo, 1904.
(4) "Irrigation in the United States," by F. H. Newell.

conservation of the water supply and the reclamation of the arid lands of the West, and their settlement by men who will actually build homes and create communities."

In Canada, with a climate much more rigorous than that of South Africa, irrigation is successfully practised, and, recently, the Canadian Pacific Railway has been furthering new schemes which will bring about 1,000,000 acres under water. Government have given that Railway a large block of land for this purpose, one quarter of which will be irrigated; already 500,000 acres of this block have been sold.

In the dry parts of old countries of Europe, such as Italy, Spain and France, which all have colder climates than that of South Africa, irrigation has been found a necessity for agricultural development, and many fine works have recently been constructed.

Coming to South Africa itself, Cape Colony is inaugurating a more scientific and extensive irrigation policy; Natal has just constructed the Winterton irrigation scheme, the Transvaal has established an Irrigation Department, and the Orange River Colony, with its limited means, has been starting irrigation schemes as relief works.

From the above short account, it may be seen that, although irrigation has attained its greatest development in tropical countries, the white man, in arid countries like parts of South Africa, has found it a necessity and is rapidly increasing the irrigated area. It would be remarkable if in South Africa alone, where water is badly wanted, where the price of agricultural produce is probably higher than it is anywhere else, and where so great a proportion of it is imported, that irrigation should not be a success.

In some countries irrigation is a vital necessity; in others, it is eminently desirable; while in others it is not wanted. The Colonies of South Africa fall under the second description, and in them irrigation is much appreciated. They can accept with confidence as a guide the experience of similarly situated countries such as the Western States of America, where irrigation has been a great success and is rapidly extending. It is not necessary that the similitude should be exact; the underlying general principles can be followed, the general results intelligently applied, and development more quickly obtained by avoiding the mistakes which have elsewhere been committed through inexperience.

4. Advantages of Irrigation.

The following may be stated as some of the advantages of irrigation:—

(*a*) Without it the success of agriculture cannot be assured in the arid parts of South Africa.

(*b*) It will permit more stock to be raised, as by it fodder (such as oat hay) can be produced at a cheaper rate than it can be imported owing to its bulky nature; moreover, green fodder, such as lucerne,

cannot be imported in a succulent state. In its turn, stockraising will help irrigation by the manure produced by it.

(*c*) It will cheapen the cost of living by reducing the amount of imported produce.

(*d*) It will afford congenial employment to the rural population which has never taken to mining.

(*e*) Intense cultivation will mitigate the effects of the present law of inheritance by which estates are being gradually subdivided into otherwise unremunerative small holdings. It will thus tend to prevent the formation of a poor white population.

(*f*) It will permit of the formation of settlements with common aims and objects which will lead to the fusion of the white races.

(*g*) Irrigation in India and Egypt brings in to the State a large return on the expenditure incurred upon it. It should, at least, be self-supporting in these Colonies and will probably be directly remunerative.

(*h*) In India and Egypt it is recognised that the indirect advantages of irrigation in increasing the wealth of agriculturists conduce greatly to the advantage of the State, and thus justify the construction of works not directly remunerative in themselves. The same will hold good here, as an increase in the purchasing power of a large section of the community must benefit the rest of it.

(*j*) Agriculture (and this includes irrigation) is the most permanent of all industries ; it is advantageous to the country as a whole to foster it, especially while its revenue is increased by the profits from mining which may eventually diminish.

(*k*) Irrigation will, in favourable circumstances, permit of two crops being grown annually ; that raised in the cold season will not be liable to damage by floods, hailstorms and locusts, and will thus be practically secure.

(*l*) Irrigation works can be constructed almost entirely by local labour, as but an insignificant part of them will have to be imported. Their construction will, therefore, benefit the resident labouring community. In this respect they compare most favourably with railways.

5. Alleged Non-Requirement of Irrigation.

By some it has been stated that irrigation is not wanted because:—

(*a*) The population is too small to require it;

(*b*) It will be cheaper to import produce than to grow it;

(*c*) Owing to the high price of labour it will be impossible to export surplus produce.

Generally, it may be said that such objections are raised by persons who have not resided long in the country or who have not had experience of the success of irrigation in other countries. It is surely more reasonable to attach greater importance to the opinions of those

who have been born and bred in the country and of those who have seen what irrigation has done elsewhere. Both of these latter classes are greatly in favour of developing South Africa by means of irrigation. (*Vide* "Agriculture Within the Empire," pp. 138-140).

Theory is all very well, but it is not always reliable. A few years ago it was said that plantations would not be successful near Johannesburg. The Sachsenwald one is now a proof of the fallacy of this idea. It is far better to rely upon the results of experience, even if that has been obtained in other countries.

The following remarks are made as to the objections stated above:—

(*a*) The total population of the Transvaal by the last census (1) was 1,268,716, and the cultivated area in 1902-3 was estimated at 391,000 acres (2), or only 0.31 acre per head, which is quite insufficient for the support of the inhabitants. Of this area, by far the largest proportion is devoted to the growth of mealies, an unirrigated crop. In addition, it is estimated that there are 6,667,000 acres (3) available for cultivation. Everyone anticipates that mining and other industries will rapidly expand, immigration is taking place, and it is well known that the Dutch and Native inhabitants are prolific ; from all of these causes the population should largely increase. Naturally, the best lands have been put under cultivation first, and it is uncertain if agriculture, unaided by irrigation, will be able to keep pace with the increase of the population.

(*b*) The customs returns for the year ending 30th June, 1905 (4) (*Vide* Appendix 1), show that over £2,000,000 of agricultural produce which could be grown under irrigation, was imported. This is evidence that much lee-way has to be made up, and the increase of population will for long be in advance of the increase of irrigation.

(*c*) It is doubtful if agricultural labour in the Transvaal, after conditions have become more settled, will be as high-priced as it is in purely white Colonies, for here cheap native labour is procurable and will probably be then available for agriculture. It is the experience of other Colonies and of America that, even with their high rates of labour, they are able to export agricultural produce to other countries with cheaper labour owing to favourable natural conditions of climate and soil. Irrigation in South Africa will permit of the growth of lucerne, oat hay, wheat and other crops which can be consumed locally, and of fruit, tobacco and semi-tropical produce which can be exported at a profit. It is well known that America, by greatly developing its iron industry, has been able to compete with English trade by exporting its surplus production at cheaper rates than are obtained in its own market, and South Africa should be able to adopt the same principle in regard to its agricultural products.

(1) Transvaal Census Report, 1904
(2) Transvaal Administration Report for 1903.
(3) Transvaal Administration Report for 1903
(4) Report of the Transvaal Agricultural Department, 1904-05.

6. Political Considerations.

Politics are not in the province of the engineer, but, as in this country, they pervade everything, so they affect the question of irrigation. In all countries there is a conflict of interests between Town and Country. Here this is intensified by the fact that the former is associated with the British and with capital, and the latter with the Dutch and with poverty. All prominent politicians state their earnest desire to fuse the two races into one; and in no better way can this be done than by developing agriculture (and with it irrigation) so as to convince the rural population that their interests are not being sacrificed to the requirements of the urban portion of the community.

The Dutch population has not taken, and probably will not take, to mining, whereas the pursuit of agriculture is peculiarly congenial to it. A reasonable amount of State assistance in the development of agriculture will be most acceptable to it, and, in turn, will benefit the mining community by reducing the cost of living. One of the best forms of such assistance is the construction of irrigation works, the capital cost of which is beyond the means of private persons. At the same time, as such expenditure should be productive, its disbursement will not tend to pauperise the people. The Dutch are a prolific race, and, unless increased means of agriculture, such as irrigation affords, are placed at their disposal, it is almost certain that the existing poor white population will be increased. This has always been recognised in South Africa as an element of danger to the State, and, particularly so, because the larger proportion of the population is a coloured one. Before the war there was special legislation on this subject; even now cases have occurred in which poor Boers have ploughed lands for Kaffirs. Without irrigation it will be practically impossible to establish settlements of British and Dutch. To plant British settlers out at long distances from each other on separate farms will be of little use in preserving their characteristics, the retention of which is so desirable.

These are the broad political considerations which justify the extension of irrigation as required by the development of the country. It is, however, sincerely to be hoped that irrigation will not be prostituted to party considerations, for, if it is, experience has shown that its progress will inevitably be arrested and its benefits diminished.

7. The Main Classes of Irrigation Works.

In regard to their size, irrigation works may be thus classified:—

Small works—to be constructed by private enterprise;

Medium-sized works—to be carried out by Water Boards and Associations of Farmers;

Large works—to be executed by individual Colonies under State management;

First class works—to be prosecuted by Inter-Colonial State agency.

These classes of works are not competitive with each other; they are, in fact, complementary to each other; each of them has its own particular use and is peculiarly adapted to the development of areas which cannot suitably be dealt with by the others. The advantages and disadvantages of each class will now be described shortly.

8. Small Works.

These, as a rule, will be small storage reservoirs and furrows led from springs and small perennial or semi-perennial streams.

The advantages of such works are that they will utilise small catchments and small natural physical features, and that they will provide for the irrigation of small isolated areas which could not otherwise be supplied with water. They can be made cheaply by means of local labour, and, as they will not require high-class engineering, they can be carried out by farmers with, if necessary, a little professional advice and some assistance from the State by means of loans. They are eminently suited for private effort, and they can best be constructed by individual farmers who are the best judges of local conditions and requirements. Their construction will develop enterprise, and their maintenance and utilisation will encourage independence, as they will be under the sole control of their owners. By their means farmers will be enabled to grow high-priced crops, to practise intense cultivation, and, generally, to develop their farms. The disadvantages of such works are that their cost per unit of supply will usually be excessive, their supply may fail in bad years, and, even in good years will, in many cases, prove insufficient to last until the end of the dry season when it is most useful for starting crops. It would be impossible for the State to undertake such works with economy in construction or maintenance, or to administer and collect revenue from them. All that it can do is to assist farmers by loans and by professional advice, and thus to lead to the establishment of numerous works all over the country so as sensibly to increase its productive powers.

9. Medium-Sized Works.

These will generally consist of medium-sized storage reservoirs and furrows led from the smaller rivers; of works for the drainage of "vleis" and swamps, and the reclamation of fertile bottom lands; for the opening up of the sources of springs and the improvement of the channels of the smaller rivers; and for the linking up of numerous furrows where they exist so as to utilise the available supply more economically. Such works will improve the agricultural conditions of a district. The advantages and disadvantages of these works will be similar to those described for small works, but, generally, their material advantages will be greater and their disadvantages will be less than those of that class. They will have the further advantage of inducing co-operation without much surrender of individuality, seeing that the schemes will be managed by the popular vote of those benefited by them.

As far as investigation has gone in the Transvaal, there are not many suitable sites for medium-sized reservoirs. This is due to the fact that on the high and middle veld the slopes of the smaller rivers and of the country through which they run are very steep, being on the highly elevated crest of the sub-continent, and also to the valleys being restricted in width and having few cross ridges suitable for the location of dams and waste weirs.

10. Large Works.

These will usually take the form of large storage reservoirs constructed on streams with fairly large catchments, and of moderate-sized canals led from rivers with fairly good perennial flow. The expense of the construction of such works will generally be so great that they will be out of the reach of Water Boards, as it is not likely that the State will feel justified in advancing to them loans of the necessary magnitude. Their construction will also involve high professional skill, and their maintenance, considerable administrative ability, both of which can best be supplied by the State.

The direct financial returns from such works will probably, for many years, be small, as development by irrigation is slow, and, even when full development is attained, will not be so great as to tempt commercial enterprise to embark on such schemes. The State can, however, profitably undertake them; it can afford to wait for the complete development of its projects, and it can be content with moderate direct returns which will be accompanied by indirect returns from which it will also reap benefit. Moreover, for these reasons, the State can be a more liberal owner than can a financial corporation, and the irrigators will thus gain increased advantage by being placed under an administration which has for its main object, not high profits, but the general advancement and prosperity of the agriculturist which will lead to those of the whole community. The State is justified in looking upon sound irrigation schemes as public works for the development of its territories, just as much as are roads and public buildings from which no direct return is received.

The advantages of large compared with small storage reservoirs are their cheaper rate of storage; they are the only ones which can take full advantage of the run-off from large catchments. They are also the only ones economical on them, seeing that, for any given catchment, the size and cost of the waste weir are independent of those of the dam embankment, while the cost of the outlet and the puddle trench do not vary greatly with the general scale of the project. The mean depth of large reservoirs is much greater than that of small ones, and thus, in the former, the proportionate loss by evaporation is much less than it is in the latter. This consideration is of much importance in South Africa where the quantity of such loss will probably be equivalent to an amount of storage equal to the mean area of a reservoir multiplied by a depth of 4 feet. Further, a small reservoir on a large catchment will silt up much more rapidly

than a large one on it, for both will intercept very nearly the same amount of deposit. The advantages of large canals from large rivers are that these works also utilise more fully the natural asset of water available, and that these rivers have a greater and more certain perennial flow, especially in bad seasons, than have small rivers. As the larger rivers naturally have considerable floods and usually run in deep troughs, to secure immunity from damage, the canals from them must be rapidly led out of the flood margin and on to the country. Thus, small canals taken out from them will require headworks practically as expensive as those of large ones, and will, therefore, *pro rata*, be more expensive, while their benefit to the country will be much less. Moreover, a large canal can carry water more economically than a small one, and can more rapidly gain command of irrigable land. In some cases it will be possible to construct the canal first and thereafter to provide storage for it when this development becomes necessary; such procedure in gradual stages will generally be the most advantageous one to adopt, as irrigation is usually a plant of slow growth.

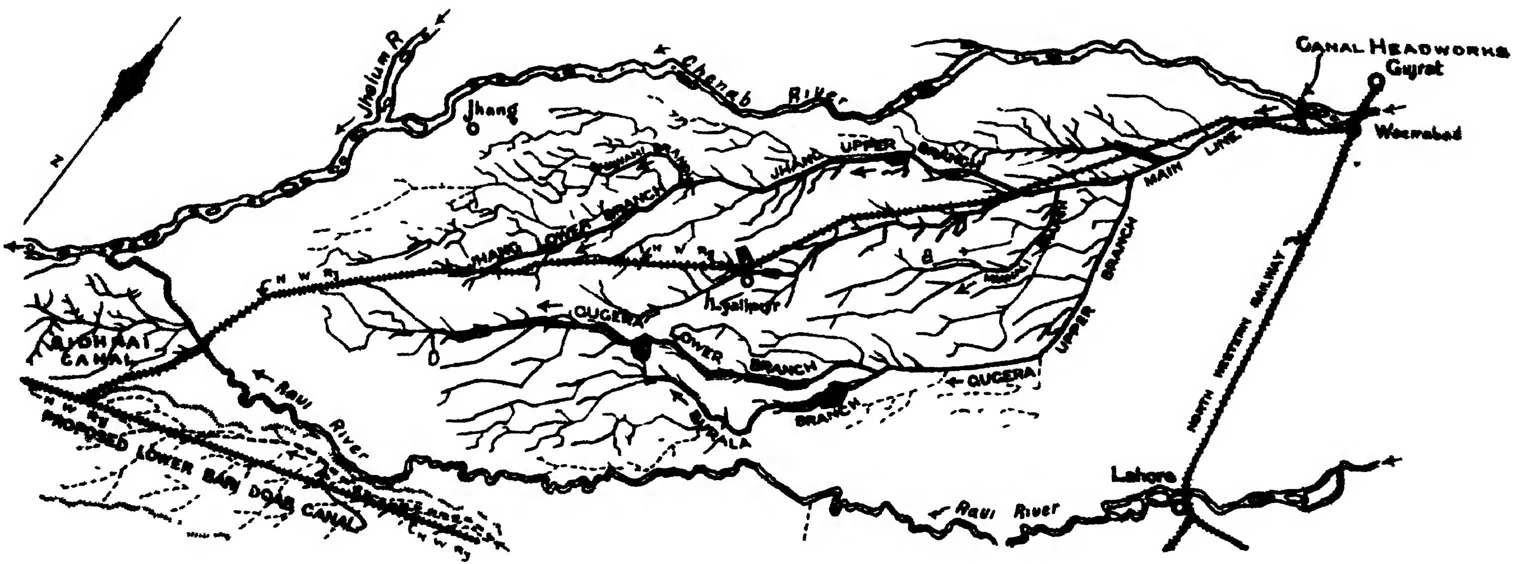
Taking both large reservoirs and large canals together, their advantages are that they better utilise the natural assets of more certain supply and of the flatter slopes of the country which characterise large catchments. The larger rivers have the further great advantage that on them there are fewer established riparian rights, so that more comprehensive schemes can be established on them with less interference with such rights. It is, moreover, an irrigation maxim that a scheme must be on a scale having a direct relation to that of its source of supply, or its cost will be unnecessarily great and its utility will be needlessly diminished.

Compared with small schemes, the cost of both the construction and maintenance of fair-sized schemes per acre irrigated will generally be considerably less and the charge for water supply can, therefore, be reduced. It is thus more economical for the State to undertake such projects and more beneficial to the country as a whole to have large areas irrigated. The disadvantages of large works may be said to be their great cost, the uncertainty of getting all irrigable land under them occupied and the chance of constructional failure. On the other hand, fears have been entertained of their too great success, whereby the market will be swamped and small farmers on dry lands will be unable to compete with irrigators under them. The answer to the first set of objections is that they should not carry weight in a progressive country if the programme of construction is properly adapted to its requirements, seeing that there is the experience of many other countries available as a guide, and the successful completion of numerous schemes in them as an encouragement. The replies to the second set are that even the enthusiast in irrigation in making his proposals will surely be restrained by reason and will not suggest so many schemes as will wreck the financial prospects of all, and that, as explained above, there is in this country ample scope for the

Plate CXXII.

GENERAL PLAN OF CHENAB CANAL

SCALE 25 MILES = 1 INCH.



successful existence, side by side, of schemes of different magnitude and for different classes of agriculture.

11. First Class Works.

So much has just been written about the class of "large works" that but little remains to be noted concerning "first class works." Their advantages will be still greater, as these works will be constructed only on the large rivers which have the most assured supply and are the largest irrigation asset of the country, but one which cannot be properly utilised except by schemes of considerable magnitude. Moreover, these rivers traverse the parts of the country with the most suitable physical conditions, not only for irrigation, but for the all-important matter of easy communications. The larger an irrigation work, the more likely is it to be a financial success, for the concentration of irrigation will enable cultivation to be carried on in the cheapest manner by means of the most modern agricultural implements, and the water supply to be utilised most economically. The construction of such a work will enable central depôts to be established for crop, dairy and meat produce, such as manufactories, creameries and cold storages. The farmers under it can thus combine and, without the help and cost of middlemen, can capture and retain the home market now so largely supplied from oversea. The exporting countries are, moreover, so geographically remote that competition with them should not be difficult if it is arranged for by proper scientific methods, of which those very countries have shown the value. The magnitude of the irrigation operations will not only justify, but will demand, the construction of good roads and branch railways that will furnish the means of cheap transport, the lack of which at present is the principal factor permitting oversea competition to be successful.

As an example of the value of a first class work, the Chenáb Canal (1) in the Punjab, the largest recent project in India, may be quoted. This canal is taken out (*Vide* General Plan, Plate CXXII.) on the left bank of the Chenáb, the second principal tributary of the Indus, and irrigates the area between the Chenáb and the Rávi, which previously was a very sparsely inhabited and desert tract of Crown land. It was originally completed in 1887 as an inundation canal, *i.e.*, one without a weir and entirely dependent for the amount of its supply upon the fluctuating level of the river. Such a canal did not take full advantage of the amount of water available, and, accordingly, the construction of a weir, with regulating works, was sanctioned in 1888, and the remodelling of the canal itself, in 1892. At its head it is 250 feet wide and 10.8 feet deep, and it carries 10,800 cubic feet per second; in other words, its discharge is as large as that of the Thames at Twickenham in flood. The weir was completed early

(1) Recent Developments in Punjab Irrigation by Sidney Preston, C.I.E.—Journal of the Society of Arts, Vol. L, No. 2,586, May 30th, 1902.

in 1892, and since then the expansion of irrigation has been extremely rapid, as the following table will show :—

	Acres irrigated.
1892-3	157,197
1897-8	810,000
1902-3	1,829,169

Eventually, it is anticipated that it will irrigate 2,500,000 acres. Its capital cost up to 1902-3 was about £1,830,000, and the net return on this expenditure in that year was 21.3 per cent. The population has increased from a few thousand nomads, possessing only camels, goats, etc., to 792,000 agricultural colonists (1901 Census) inhabiting towns and villages, and, for India, in most affluent circumstances. Early in the history of the scheme a railway was seen to be an absolute necessity, but, unfortunately, some years elapsed before funds were available for its construction. The colonisation scheme at first very nearly failed, owing to the impossibility without the railway of transporting the immense quantity of produce and of realising its value and thus paying the Government assessment. By means of this and other large Punjab canals, the export trade of Karachi has increased enormously, and, last year, for the first time on record, the export of wheat from India to England exceeded that from any other country.

12. Inter-Colonial Irrigation Schemes.

The two largest rivers of the most thickly populated part of South Africa are the Vaal, forming the boundary between the Transvaal and the Orange River Colony, and the Orange River, which, for a considerable length of its upper course, divides the Orange River Colony from Cape Colony. While Nature has thus made them lines of separation, man, by utilising them for irrigation, can constitute them into bonds of union. By the construction of masonry weirs and dams across these rivers, reservoirs common to the neighbouring Colonies can be formed, and from them canals can be led on each side for the irrigation of their respective territories. The natural conditions being equal, a single canal supplied by a storage reservoir is nearly 1½ times as expensive per acre irrigated as two canals led out from it on the two banks of the impounded river. The financial advantage of co-operation is thus great, and a further benefit of this nature is that the schemes will be constructed from the revenues of two Colonies, instead of one, and will thus involve a smaller demand on the resources of each.

Sir William Willcocks, in the middle of page 41 of his "Report on Irrigation in South Africa," suggests that the waters of the Vaal should be reserved for the Transvaal and the Orange River Colony, while those of the Orange River would be available for Cape Colony. How far the upper course of the Orange River can be utilised by the two Colonies which it divides is not known to the author. The development of inter-colonial irrigation from the Vaal has, however,

formed the subject of an extensive reconnaissance of the river over 500 miles long by engineers deputed to it from the Transvaal and the Orange River Colony. Their investigations have proved that four schemes serving both Colonies are practicable and desirable. A further examination of the lower part of the Vaal by engineers of the Transvaal and Cape Colony has shown that probably the best scheme on the river is available there for irrigation in these two Colonies, and, possibly, also in the Orange River Colony. The approximate figures for these projects are given in the following table :—

Particulars.	Unit.	Klip River	Koppies-fontein.	Lindiques Falls.	Coalmine Drift	Christiana and Hartz River
(a).—Excluding increased value of land rendered irrigable.						
1. Total estimated cost of project	£	283,000	945,000	285,000	515,000	1,144,000
2. Full-supply storage	Mill cft	4,165·82	5,545·32	2,403·73	2,603·96	11,451·00
3. Estimated rate of storage	£ per Mill cft.	33·36	38·50	47·80	10[illegible]·30	31·44
4. Area irrigable ..	acres.	21,600	60,000	18,000	26,000	90,000
5. Cost per acre irrigable (1) ÷ (4)	£	13·10	15·70	15·83	19·80	12·71
6. Estimated net revenue	£	16,200	48,000	18,000	32,500	67,500
7. Percentage return of (6) on (1)	p.c.	5·72	5·08	6·63	6·31	5·90
(b).—Including increased value of land rendered irrigable.						
8. Estimated increased value of land at £10 per acre	£	216,000	600,000	270,000 (At £15 per acre.)	390,000 (At £15 per acre.)	900,000
9. Net estimated cost of project (1) — (8)	£	67,000	345,000	15,000	125,000	244,000
10. Percentage Return of (6) on (9)	p.c.	24·18	13·90	126·00	31·00	27·65

It will be seen from this table that, although the schemes proposed are of fair size, none are of heroic dimensions, and, compared with the Chenáb Canal, are on a moderate scale. There are, however, but very few other projects in the Transvaal from each of which even as much as 20,000 acres can be irrigated, and that with less certainty of supply and at greater cost than those from the Vaal.

The Orange River Colony has drawn up a very large scheme at Parijs for the irrigation of some 300,000 acres at a cost of about £3,000,000. It is possible that this scheme could be extended at a total cost of £5,000,000 to irrigate an additional 100,000 acres in the Transvaal. Unfortunately, it is on far too ambitious a scale for the present requirements of the two Colonies, and it cannot be commenced on a smaller one and be subsequently enlarged. The time may come,

however, when it will be wanted, and it is as well that it should not be lost sight of. Schemes of the magnitude described above may have the advantage of rendering the climate in the neighbourhood more humid, and, if this proves to be the case, their benefit will extend beyond their own immediate limits.

13. Inter-Colonial Co-operation.

Irrigation schemes of all sizes have now been discussed broadly, and chiefly from the engineering point of view. It has been pointed out that each class of scheme has its own special utility, and that, if any scheme fulfils the main requirements of feasibility, suitability, desirability and moderate financial success, it can be undertaken with confidence. It is, perhaps, needless to add that each project should be carefully and fully investigated before it is started, so as to avoid the commission of costly mistakes. It now remains to make a few general observations on the main subject of this paper.

Although the Colonies are at present only in their preliminary stage of development, difficulties have arisen in regard to water questions connected with the Vaal owing to the deficiency of its supply at the end of the fair season. During each of the last three years its flow at Christiana has practically ceased for two or three months, and is likely to fail this year for a considerably longer period. The restriction of irrigation from its upper tributaries has even been suggested so as then to secure supply to the lower riparian towns in Cape Colony including Kimberley. It is hardly necessary to point out that, even if this were practicable, it would be a retrograde step to take, and it would introduce inter-colonial friction instead of co operation. It is, however, not practicable, as the laws of each Colony run only within its boundaries, and the upper Colony would certainly never consent to being deprived of its natural resources for the benefit of the lower Colony.

Considering the case of two Colonies separated by a river, the best way, theoretically, is to divide its flow between them in proportion to their contributions to its discharge. Such discharge depends upon the extent of the catchment area, the nature of the country and the intensity and amount of the rainfall. To determine the discharge to which each Colony has a fair claim would take many years of observation, and, even when determined from the results ascertained, the proportion arrived at, might, with the variation of rainfall in a subsequent season, then prove an unfair one. Owing to the great fluctuations in the flow of even these large rivers, to depend upon them in their natural condition will frequently lead to difficulty. The obvious remedy is to reduce these fluctuations artificially by means of storage weirs and dams, whereby a definite amount of supply can be obtained in all years and can be divided in accordance with settled arrangements effected jointly by the Colonies concerned. Thus, all chance of inter-colonial friction will be prevented by means of inter-colonial co-operation, which will establish a community of interests

that must inevitably form a bond of union. An excellent instance of the benefits of such co-operation is the appointment of the Inter-Colonial Irrigation Commission upon which are representatives of the Transvaal and Orange River Colony. This Commission is enquiring into the best way in which the existing irrigation law can be amended so as to meet the altered conditions which now exist. Without a new law suitable to those conditions, the proper development of irrigation will be impossible.

The tendency in new countries (and one which, unless it is extirpated at the outset may be intensified as time goes on) is to consider first, individual, rather than collective, requirements, and to look at everything from a narrow rather than from a broad point of view. Fortunately, South Africa has already furnished several examples of the advantage of co-operation. In State affairs there are the Customs Union and the joint management of railways in the Transvaal and Orange River Colonies which, it is hoped, will be extended to Cape Colony. In commercial affairs, there are the gold fields of the Rand, which, under the most adverse natural conditions, produce the largest output in the world, and the Kimberley diamond mines, which, from a congeries of petty individual effort, have developed into the most productive combination known. By this co-operation, scientific development has enormously advanced, and, by a similar one, it is probable that irrigation engineering will equally benefit for the good of agriculture all over the Colonies. Agriculture is the oldest and most permanent industry in the world, and is practised by the large bulk of its inhabitants. Anything that tends to its development and renders it more certain, will benefit the whole population, and nothing can ensure this better in South Africa than the construction of large irrigation schemes on well considered and sound lines.

Appendix 1.

Statement of Imports of Agricultural Products into the Transvaal for the Year ending 30th June, 1905.

(*Report of Agricultural Department*, 1904-5, *page* 44.)

	Quantity.	Value.
Corn and Grain.—	Lbs.	£
Beans and Peas	4,421,947	18,592
Chaff	577,166	830
Dholl	442,193	1,689
Kaffir Corn	5,697,807	17,464
Lucerne and Fodder	36,493,257	81,385
Manna	4,237	37
Mealies	88,645,632	194,324
Oathay	43,129,970	94,106
Oats	30,483,895	77,751
Wheat	2,428,721	11,152

Flour and Meal.—		
Wheaten	89,169,764	432,306
Other kinds	7,498,945	24,335
Vegetables (Fresh).—		
Onions	4,957,401	20,537
Potatoes	14,616,797	49,897
Preserved	2,193,818	24,401
Total		£1,048,866
Preserved Meat	6,479,517	186,984
Fresh Meat and Game	63,473,722	794,229
Grand Total		£2,030,079

(NOTE.—In addition to these, considerable quantities of butter, milk, cheese, margarine, eggs, bacon and ham were imported.—W. L. S.)

THE POSSIBILITIES OF CLOSE SETTLEMENT ON THE CROCODILE RIVER.

By H. Rose-Innes, R.M., Pretoria.

IT is often said that the Transvaal is more essentially a pastoral than an agricultural country. This certainly holds true at the present time and will do so for a long time to come. As a pastoral country it has, within the last twelve years, suffered three severe checks and setbacks.

In 1894 rinderpest swept over a greater part of the country, and many herds of cattle were destroyed before science could come to the rescue and make rinderpest a disease no longer to be dreaded. In 1899 war broke out between the late Republics and Great Britain and continued to be waged for a period of nearly three years. As a result of the war the country was almost entirely denuded of its live stock. In order to replenish, cattle were, after the war, imported from many parts of the world. Some, brought from the East African hinterland in June and July, 1902, introduced the disease known as East Coast Fever or Rhodesian Redwater into this Colony, and pastoral farming suffered its third and, let us hope, its last severe blow.

It is quite natural that, under the circumstances above set forth, men were to a large extent forced to go to the soil itself for a living. Immediately after the war, with the pressure of want which it had brought in its train, the energies of the farmers were more strenuously directed towards getting their wants supplied from the soil, and a large—and unprecedented—amount of cultivation, both by dry tillage and under irrigation, resulted. The endeavours so put forth in 1902 show no signs of relaxing; on the contrary, the improvement in the condition of the farmers and the better resources at their command, which the march of time brought along, have induced greater efforts at production.

There are three eras in the European history of the Transvaal. The first may be said to be the Hunter's Era, when subsistence was largely got from the chase. The hunter was then also a soldier. This was the time when the Voortrekkers penetrated into the wilderness and warred with the native tribes, preparing the country for settled occupation by Europeans. With the settled conditions which supervened arrived the Pastoral Era. Capetown, Pietermaritzburg and Durban were then the chief markets. Railways were not even dreamt of in those days, and the difficulty of transport militated against agricultural enterprise as it does even to this day. Maritzburg and Durban traded wheat, dried fruit, tobacco and the products of the chase from the Transvaal farmers. The trade in agricultural produce was, however, very limited. Cattle constituted the chief wealth of

the farmers. These could be more easily moved to the centres of trade and constituted the most profitable source of farming. Diseases were, in those days, rare and almost unknown. With the discovery of the Gold Fields and the creation of markets nearer home, and when the conditions which the late war brought about supervened, it may be said that the Agricultural Era dawned. It does not, however, follow that the agricultural is going to replace the pastoral industry in the same way as the pastoralist replaced the soldier-hunter. The fact that men became largely dependent upon the soil itself for a living has quickened interest in agriculture and made it a better established industry, one to which more energy and serious attention is now devoted.

When animal diseases have been eradicated and their re-introduction made humanly impossible—a consummation of the efforts of the Government in that direction to which the public are hopefully looking forward—and the foundations of the pastoral industry broadened and enlarged by the breeding and rearing of ostriches and a suitable class of small stock in parts of the country where this has never before been attempted ; then only, I think, will the strength of the pastoral resources of the country stand revealed.

With the interest in agriculture which better and more accessible markets and the latter-day conditions of this Colony have stimulated, the matter of irrigation is one which to-day stands in the forefront in dealing with the land problems of this country. Attention has, in the first place, been directed towards turning the perennial waters of the country to fuller account. This has resulted in considerable expansion of the agricultural industry. This expansion from the source indicated has naturally been more marked in, if not almost entirely confined to, territory situate within easy reach of the big markets of the country. Nowhere has a better example of this expansion been furnished than in the Valley of the Crocodile River in the Pretoria District. Irrigation canals have been recently, and are still, to-day, being taken out at and constructed along higher levels in defiance of the provisions of the existing statutory irrigation law of this Colony (Law No. 11 of 1894). In some, the commercial spirit, but, in most cases, necessity arising from the growth of the family has dictated the prosecution of these enterprises. In addition to work accomplished and in hand, further schemes are at the present moment under consideration.

Involved with the question of irrigation is that of close settlement. This has occupied the attention of the Government and the people of this Colony very considerably since the war. The necessities of the poor and the provision to be made for the immigrant have made it bulk largely before the public eye.

Immediately after the war and as part of the Repatriation scheme, the Burgher Land Settlements were founded. In mentioning these I only wish to refer to those laid out on land under irrigation. With these Land Settlements the first attempts at close settlement on any ambitious scale were made. Before the war the question of forming

such land settlements with State aid was under serious consideration by the late Government, and but for the war which intervened, the late Government would, I believe, have embarked on the enterprise of forming such settlements as a solution of the poor white question. It is a settled conviction with me that the best subsistence for the small farmer is to be had by the cultivation of land under irrigation. With limited resources, small holdings only can be worked by him, and that is how close settlement results. Such close settlement has been known for a long time past and can be seen along the banks of the Crocodile River. It has been the result of family growth. The riparian farms were originally granted to individuals. The families and descendants of these original grantees are, to-day, to the third and fourth generations, existing on the land. As the family grew and a fresh generation had to be provided for, so more land had to be brought under irrigation. For the purpose of such expansion the storage of water has never been attempted, the perennial water in the stream being entirely depended upon.

At the time I laboured on the Pretoria Indigents Commission, and when the question of forming close settlements under irrigation for the local poor was considered, the attention of the members of the Commission was directed towards the Crocodile River Valley as one of the most suitable localities in the whole Transvaal for the formation of these settlements. The report of that Commission has gone the way of nearly all Commission reports—into the pigeon-hole. Interest in the matter has, however, been revived by the Dutch Reformed Church which has in contemplation the formation of a settlement in the Crocodile River Valley. The conditions for the formation of such settlements in the valley can hardly be improved upon so far as land and soil and accessibility to market are concerned. Land there is in plenty and soil of best quality and of wide range and variety. Cereals, tobacco, fruit, including the citrus varieties, and lucerne can be grown to great perfection on irrigated land. The locality is tapped by the railway, and health conditions are not unfavourable.

The great question, however, to be considered is whether the perennial water in the stream will be sufficient to irrigate more land than what is at present, or will soon be, under water. On a recent tour down the valley, I found some of the lower riparian owners suffering from want of water. This is a time of exceptional dearth, and it is not, perhaps, a fair test to apply the present condition of the river in determining the question. One thing is certain, that the increased amount of land being put under irrigation higher up the river has become a matter of grave concern to the lower riparian owners, who see in this increased cultivation higher up a diminished chance of a strong constant and regular supply of water lower down. I have for some time past been of opinion that the limit of expansion which the perennial flow of the river will admit of has very nearly been reached, and that, if further expansion of the nature contemplated is to take place, the present supply of water will have to be augmented

by storage of the summer and flood waters. The construction of storage dams on the tributary spruits of the river, with canals connecting such dams with the river, is a system which has in some instances already been resorted to for the purpose of accumulating a reserve of water for the dry season. Whether this will ensure profitable cultivation on a large scale seems to be very doubtful. It seems to me that we shall eventually have to fall back on the well-known Crocodile River Poort (Hartebeestpoort) scheme. The suggested construction of a large reservoir in the narrow gorge which the river has cut for itself through the Magaliesberg mountain is not a new idea. It is a scheme which has found enthusiastic support from engineers like Karlson and Struben, who have laboured at it, and a no less authority than Sir Benjamin Baker, who, on the occasion of the recent visit of the British Association, visited the site, and stated that he saw nothing impossible in the scheme, provided the mountain formation, which has not yet been tested, is sound. The construction of such a reservoir, which would have a catchment area of 1,600 square miles, will admit of the cultivation of some of the best soil in the Transvaal on a scale almost unlimited, and it is to my mind the only means by which close settlement on a large scale can be effected and by which satisfactory provision can be made for the poor and landless of the ccountry, and for the immigrant. It is the potentialities which are locked up in a project like this which creates an interest amounting to fascination in the minds of men who make the acquaintance of the Crocodile River Valley. The only serious objection advanced by thinking men against the scheme is that its fruition at the present time would involve a too violent transition and consequent disorganisation of the agricultural economics of the country. It is urged that the scheme is one for a somewhat distant future.

The creation of a class of sturdy self-reliant yeoman farmers in this country is an object which is well worthy to call forth the best of our national energies. By the carrying out of schemes of the nature indicated the best effort will be directed towards making this a "white man's country."

My faith is that attention will be directed towards the construction of the Crocodile Poort River Storage Reservoir sooner than is now generally anticipated. Nowhere in South Africa does there appear to be, agriculturally speaking, greater potential wealth than exists in the Crocodile River Valley.

SOME NOTES ON TOBACCO.

By J. van Leenhoff, Government Tobacco Expert.

IT is still too soon for me to enter into details about the tobacco in the Transvaal, with regard to the treatment of the plants in the field, the curing shed, the warehouse, etc., and it is still impossible to describe at the moment all the virtues or defects of our tobacco or to recommend the necessary improvements. But it may not be without interest to local growers and readers of the "Journal" if I give my impressions of certain features in Transvaal tobacco culture which I have gathered in the course of extended tours through the tobacco districts of the Colony.

In comparing the tobacco industry of Europe, the United States of America, the East and West Indies, with the industry of the Transvaal, the writer wishes only to discuss some points which immediately excited his notice under the following heads :—

1. Steps necessary to establish a standard type of tobacco in a practical manner.
2. Seed beds.
3. Irrigation of tobacco, the principles of the cultivation of the soil, and mildew or "white rust."
4. Fertilisers or manures.
5. Curing and curing sheds.
6. The tobacco is not sorted ; it is cut first and then fermented.
7. It is possible to raise in certain districts, cigarette tobacco and light sorts of tobacco for different purposes, and in other districts heavier kinds.

Before discussing the above mentioned seven points I must first state especially that the principal object of the illustrations accompanying this article is to convey to the reader some conception of the great amount of sacrifice, labour and expense to which tobacco farmers in other countries have submitted in order to gain their ends and obtain the best possible results. Everyone connected with the tobacco trade is well acquainted with the fact that there is an enormous quantity of common kinds of tobacco always offering in the market for which no reasonable price is obtainable. On the other hand, the best qualities of leaf are, it is hardly an exaggeration to say, worth their weight in gold, for the simple reason that these can only be obtained by great study, labour and expense, and the result is a great demand and a very short supply.

It is, therefore, necessary in the first place to try to produce these first-class qualities of which the supply is so limited, and after

that it is hoped that the time is not far distant when the Transvaal tobacco will not only dominate the market of South Africa but will also have the effect of reducing the importation of foreign tobaccos to a minimum, and will itself become a suitable article for export. The value of the imports of tobacco to the Transvaal for the years 1904, 1905 and 1906 was as follows :—

1904	£191,447
1905	220,610
1906	249,604

1. *Tobacco Varieties.*—Little seems to remain of the original acclimatised seed previous to the war, as, to my knowledge, very little tobacco is grown from that seed. In the course of the last few years all kinds of seed from different countries have been imported seemingly without sufficient appreciation of the care with which these different kinds of seeds have to be treated. Generally, the difficulties arising are :—

(*a*) The imported seeds are less resistent to all kinds of diseases, etc. ; consequently there is a smaller yield per acre.

(*b*) The newly imported seed produces an altogether different tobacco leaf from that which the seed obtained from its first crop. And if this is not always noticed by the farmers, it is because it is often only noticeable when comparing the leaf of each year with that of previous years.*

(*c*) The tobacco seed in the trade is not always pure as regards uniformity in the growth of the plants, and has other bad qualities such as weak germination, no resistance to climatological diseases ; and other defects.

(*d*) The tobacco plant is so sensitive to new surroundings and conditions that the finished product generally gives a different result from the quality of the original leaf if the seed is transferred from its native land to another climate. Therefore, we must, in the first place, see that the qualities of the foreign leaf, which are so much appreciated, are brought over by the seed which is imported. As this, however, requires a great deal of patience, accuracy and scientific knowledge, the Tobacco Division will give special attention to the raising of the best seed for the different districts in this country.

By "best seed" we mean the seed which produces the best tobacco with regard to burning capacity, flavour, texture, colour and form of the leaf, quantity of leaves, etc., and, particularly, yield per acre. It is hoped that a special article dealing with the selection and breeding of tobacco will appear in an early number of this "Journal."

* A very important factor for a farmer is always to keep a few samples of his crop, and if several kinds of seed are used, of each kind a sample. If he thus also keeps a certain quantity of the seed which these samples of leaf represent, he is able to compare them afterwards in order to judge better which seed would pay him best.

2. *Seed Beds.*—According to the methods hitherto followed, the seed beds are generally made too early in the Transvaal, especially in the higher altitudes.

For instance, seed beds made in April and May, which have to resist the cold months of June and July, cannot make any progress in growth if not protected well, and if germination and growth take place in the winter months the young plants are exposed to the night frosts. Violent irrigation is also very harmful, and a principal cause of the many infected plants in the field. It makes, however, a great difference if one starts at the higher altitudes in the latter end of September and at the beginning of October with transplanting when irrigation is at one's disposal. In this case, of course, the seed must, so to say, be forced by sowing it in well prepared and manured soil, in so-called hot beds made of wooden frames and covered with glass, straw, canvas or oil paper, which latter is very much to be recommended. By closing these covers over night the warmth is retained and the germination is also accelerated by keeping the seed bed dark. Watering should be done by hand at first with an air spray pump (until the plants are about a quarter of an inch high) in order to prevent the strong jets from the watering can making small canals in the seed beds, and the quantity of water must be carefully controlled.

The covering with straw, which is placed immediately on the ground, which is generally done, also has its dangers, because it hinders the growth of the young plants, and this is perhaps the cause of the screw-shaped form of the stem about which the farmers complain so often. With regard to open seed beds, I should only advise these in the low veld where no frost is to be feared. I noted with pleasure that the practice of covering seed beds with cheese cloth, as in Florida and the West Indies, has been initiated on the Tzaneen Estate, and, as far as I could judge, with success. The use of shade reduces evaporation and transpiration, and economises the soil moisture. The temperature of the air and soil is slightly raised (hothouse condition), which results in a more rapid growth and increased earliness, provided only that there is not too great a diminution of light.

For seed beds a fertile soil of medium texture is desirable, and it should be worked into the finest possible condition, and freed from all coarse organic matter. The soil should be elevated into beds not more than 3 feet in width and as long as may be desired. The elevating of the soil prevents rainwater and irrigation water standing in the beds, which is almost generally the case in Transvaal seed-beds when the water is led in the beds which are made lower than the surrounding soil. The narrow width enables the workmen to reach from either side to the middle of the beds to remove weeds without getting on the soil and compacting it. I have seen many seed-beds in this country, all of which were sown too thickly, which nearly always provokes slender plants (*see* Plate CXXXII., Fig. 3,

type *a*), with a long, thin and not well developed root system, which stand transplanting badly and never give good healthy plants. Sowing too large a quantity of seed is the cause, which can easily be avoided. So, if it is observed that they are rather close together, it is always advisable to thin them immediately, thereby giving each plant sufficient space for normal development.

A normal development generally produces more stocky plants (*see* Plate CXXXII., Fig. 3, type *b*) with well developed root system. Such plants are believed to be more vigorous, and, consequently, more resistent to all kind of troubles.

If the plants come up too thick in any portion of the seed bed, it is necessary to thin them out. This can be done most easily by using an ordinary garden rake and pulling it carefully through the thickly set plants. Sufficient plants will be removed in this way, and those which remain will not be injured by the thinning process but will be benefited by the stirring of the soil. It is also desirable to keep out all weeds, carefully pulling them as soon as they appear among the tobacco plants. Before pulling out the weeds, the bed should be thoroughly watered, and the weeds removed and carried to a safe place, otherwise they will probably sprout again. If the flea beetle or other biting or eating insect attacks the young plants in the seed bed they should be sprayed with Paris-green mixture at the rate of 1 lb. (with 2 lb. of lime added) to 200 gallons of water. If fungous diseases begin to appear in any portion of the seed bed, it should be thoroughly aired by raising the cover during the day, the affected plants and soil should be removed and a light application of lime dusted over the beds.' If "white rust" or mildew appears, dusting the foliage with sulphur mixed with one-sixth its quantity of quick-lime, or spraying with potassium sulphide solution (1 oz. potassium to 2½ gallons of water) will check the disease.*

We should have to enter into too many details if we discussed here the laying out and the keeping of good seed beds, although they are of great importance, but as the time is too late now for the laying out of seed beds, we shall deal with this question as fully as possible in another article. It is intended to take this important branch of tobacco culture in hand during next season in a practical manner on our experimental farms, and it is hoped that the tobacco growers of the Transvaal will largely make use of this opportunity to acquaint themselves with methods which have been applied with so much success in other countries, even if it were but only to avert diseases, insects, frost, etc.

3. *Irrigation, Cultivation and Mildew.*—It is common in the Transvaal to make slightly sloping land furrows through which the water runs when the young plants are set out. The disadvantages of this kind of irrigation are numerous. In the first instance it is a

* Fresh supplies of young seed plants have been sent to me, which were submitted to our Plant Pathologist, Mr. T. B. Pole-Evans. This gentleman found the mildew, *oidium tabaci* Thum., therein and recommends above-named remedy.

Plate CXXIII. **Irrigation by Wooden Troughs (Cuba)**

Plate CXXII

Overhead Irrigation by Iron Pipes (Cuba).

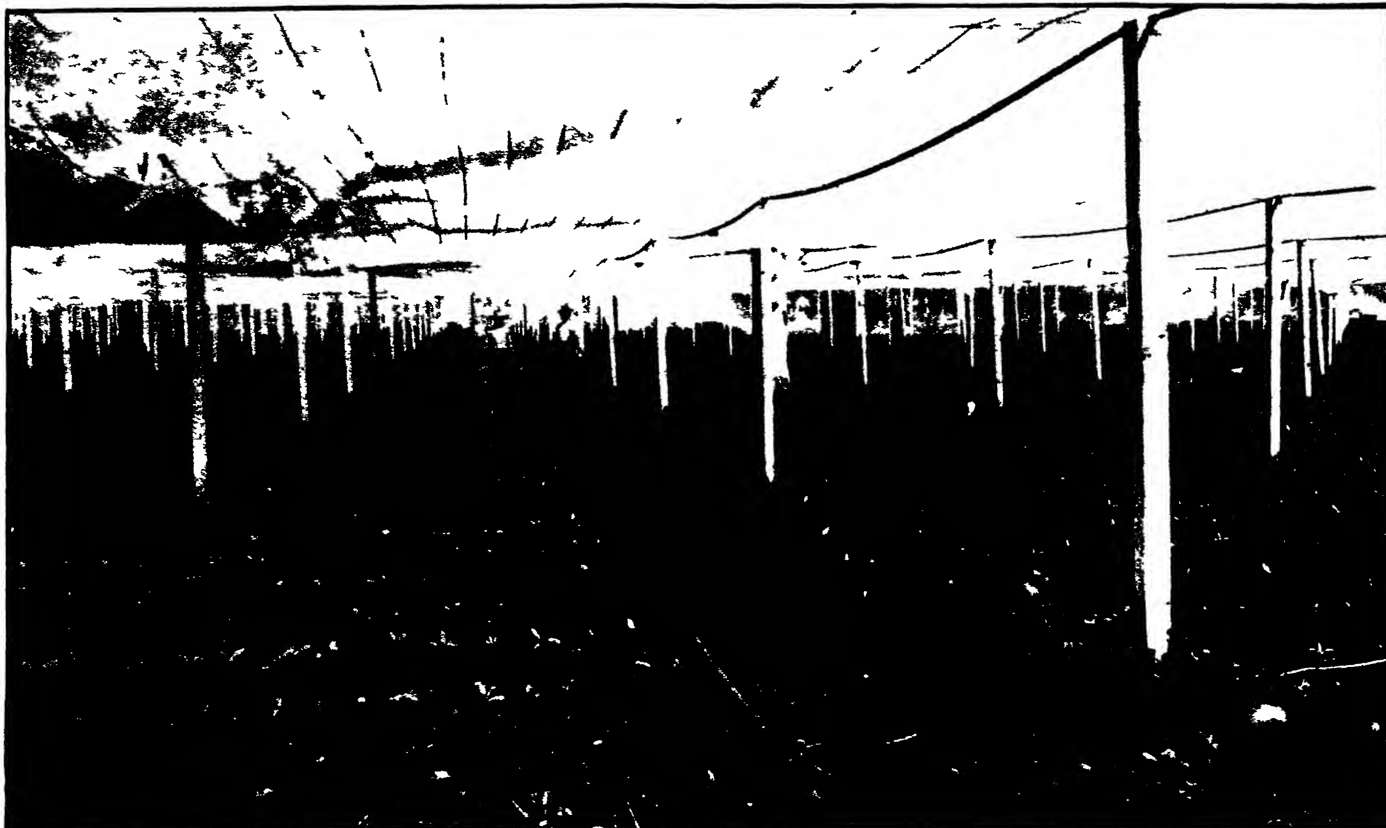


Plate CXXV

Partidos Tobacco grown under cloth shade.

Field being level, watering done by hand as shown (Cuba)

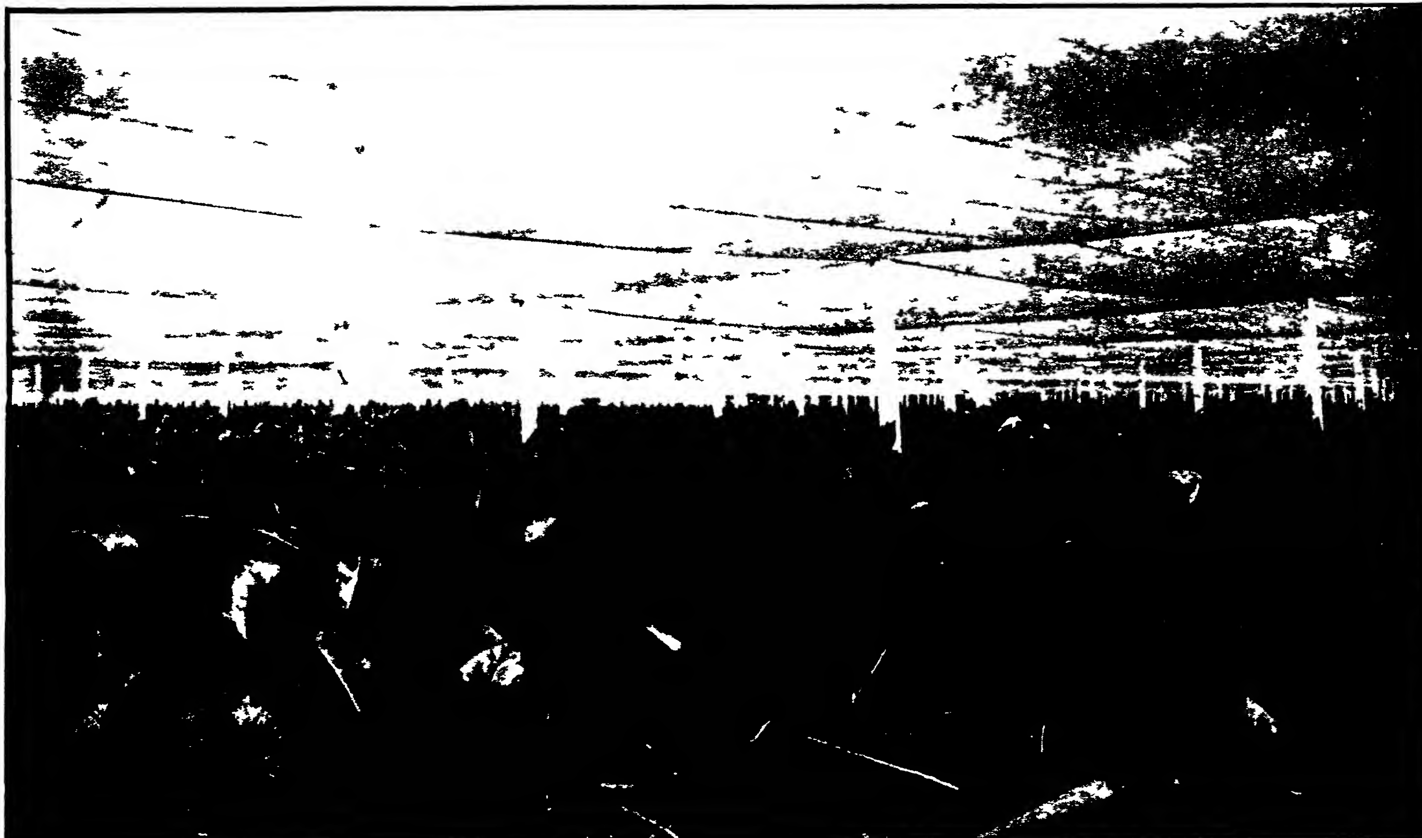


Plate CXXVI Same tobacco field as shown in Plate CXXV.; day before harvesting (Cuba).

Plate CXXVIII. Harvesting leaf by leaf (Cuba).

waste of water because, as soon as the furrows are dry, the soil bakes very easily, and by the process of capillarity the moisture of the sub-soil is lost so that a further irrigation is required. The stems and the lower leaves thus always remain wet, and, if traces of *fungi* are present, they thereby develop and spread more easily, the more so as the lower part of the plant gets more shade from the top leaves.

If one, however, intends to plant in furrows, it is a great improvement if the growth of the plants is assisted by letting the water run only once through the furrow and then covering the latter with fine soil and gradually raising the ground around the plants.

If there is any doubt as to the water reaching the roots, the furrow could be blocked in short lengths so as to allow the water to soak into the ground until it reaches the rootlets. By repeating this process along the whole length of the furrow, the water would percolate all through the soil.

It would be interesting to carry out experiments to test the amount of water that yields the best results. When this is known, farmers will be able to avoid the ill effects caused by over-watering that have been mentioned above.

Careful and thorough cultivation should be given the tobacco fields during the early growth of the plants. During dry weather the surface of the soil should be frequently stirred in order to destroy capillarity, thereby reducing evaporation directly from the soil and conserving soil moisture for the use of the plants. Any dry "blanket" that can be placed between atmosphere and the damp soil will check this evaporation. The most practical protection is a covering of finely pulverised dry soil two or three inches deep. Surface cultivation not only reduces the loss of water from the soil but also prevents an accumulation of the soluble plant food immediately at the surface and where it is out of reach of the plant roots. Cultivation should not be too deep, especially near the plants, as it destroys many of the small roots, thus lessening the feeding power of the plant. It also facilitates the formation of nitrates (nitrification). Cultivation should not be undertaken when the soil is too wet, because stirring the soil when in such a condition gives it a bad physical condition. During the process of cultivation the soil should gradually be worked towards the plants, thus hilling them up, which also prevents them from being blown down by heavy winds.

Great care should be taken that the top ground is kept loose in order to retain the moisture which is present in the sub-soil. If, however, irrigation is necessary, which is the case in many districts, we should advise the farmer to make a furrow with the cultivator between the rows and let the water then run through that furrow. In this way the water gets within the reach of the roots, and, at the same time, the growth of *fungi* is not so much encouraged. If one considers the enormous annual loss which the farmer suffers by mildew or "white rust," the suggestions about better drainage of seed beds and improved methods of irrigation on the field will surely be the

more appreciated. By this, and selection of more resistent types, it is believed to be possible to get practically rid of the "white rust."

Another great advantage in having the furrows between the rows is that the plants can be planted closer to each other. The tobacco planters themselves have noticed that in setting the plants closer together more "white rust" resulted than was the case when the distance between the plants was greater, and it is for that reason that the plants are generally set at too great a distance from each other, a question which we will discuss on another occasion.

Perhaps one may take advantage of this opportunity to show how tobacco is irrigated in other countries, and to remind the reader that no expense and pains are spared to render irrigation as effective as possible. We must, however, just mention that the illustrations are not intended as an example of what should be done here, but are intended only to show to our farmers what is done in this direction elsewhere.

Plate CXXIII. shows us the trough irrigation. The water runs through the left pipe and can be led in any direction. Observe the small holes, which can be closed with stoppers, and through which the water runs *between* the plant rows. The construction is rather expensive, but under this system a large tract of land can be irrigated carefully by one man single-handed.

Plate CXXIV. shows us overhead irrigation through pipes, which, in the case of this field (being covered with cloth shade), run nine feet above the surface of the soil, and from which the water drops on the plants like rain. The distance between the pipes is regulated in such a manner that all the plants get as nearly as possible the same quantity of water. This method has given good results, but is too expensive in practice.

Plate CXXV. shows a field with young tobacco plants in Partidos, Cuba, where, in particular, wrappers for cigars are produced. As the country is flat the plants are irrigated by means of buckets of water, and by experience it is known how many buckets of water are required for a certain number of plants. One can see the pipes spread over the field, and in several places taps are fixed on the pipes to supply barrels from which the buckets are filled, so that time, labour and money are consequently saved.

If one looks at Plate CXXVI., showing the same field as Plate CXXV., one sees immediately the benefit of irrigation and further careful treatment. Not one single deformed plant—all of the same size and as uniform as possible. I took this photograph the day before harvesting commenced. When this tobacco had been cured and fermented a certain portion of it was sold for thirteen dollars (£2 14s. 2d.) per lb.

Plate CXXXI., Fig. 1, represents a leaf of this crop. The leaf burned splendidly, was of fine texture and light structure and colour; so that the cigar which is wrapped with this leaf has a nice appearance

as regards fashionable colour and the veins in the leaf are only faintly visible. Further, by the good shape of the leaf, each side can be cut in such a way that two first-class wrappers can be made of it, and so there is no loss in the cutting. In this way the manufacturer can wrap with one pound of such tobacco a maximum number of first-class cigars, so that the price of the wrappers per cigar is not so high, and, for this reason, he is quite ready to pay a very high price for good material.

4. *Fertilisers.*—The Transvaal having been in the past chiefly a cattle country, where there was practically an unlimited supply of stable manure, demand for other fertilisers can hardly be said to have existed. The loss of the live stock, however, through the war and diseases, brought an immediate change, and so to-day the question of how much and which manure should be used has become a very important factor.

The tobacco plant absorbs many elements which are always present in sufficient quantity in the soil. Lime, nitrogen, phosphoric acid, and potash are generally present in too small quantity. The tobacco plants supply themselves with this food by means of their rootlets. If there is a lack of only one of those four above-named elements, the plant is not able to develop well. The probability of disease is great, and it is quite natural that the yield in pounds per acre will remain very small.

In a short time the Transvaal farmer also will fully understand the real value of certain fertilisers as well as, for instance, the Connecticut tobacco farmer in the United States of America, who spends a hundred dollars per acre on fertilisers, and it is considered a very good price if he gets tenpence to one shilling per pound for his tobacco, which seldom happens. The secret of their being able to spend so much money in fertilisers lies chiefly in the heavy yield they obtain—often 2,000 and 2,200 lbs. per acre. For tobacco, more than for any other crop, the quality of fertilisers has a great influence on the quality of the finished product, *i.e.*, the leaf ready to be manufactured.

It would take too long here to discuss this subject fully; therefore a few examples must suffice. Chlorine makes the tobacco burn badly (according to Pichard, 1/10,000 of chlorine in the soil is enough to produce 4% in the tobacco). Potash, on the contrary, improves the burning power, but it should be used only in the form of a sulphate, carbonate, or nitrate of potash. For light tobaccos, nitrogenous manures should be used with moderation. They have a marked effect on the nicotine. For snuff and other heavy tobaccos, since one wishes to increase the nicotine as much as possible, nitrogenous manures are very useful.

Phosphoric acid should not be used in excess, for, according to Nessler, the more there is in the soil the more the plant takes up, and too much affects the colour of the ash. Acid phosphate and basic slag

are used in preference to bone phosphate, on account of being more immediately available.

A small application of lime on most of the Transvaal tobacco farms is strongly recommended, especially in heavy soils, or those soils deficient in organic matter.

Boussingault, the well known French chemist, found, half a century ago, that the quantity of carbon, nitrogen, phosphoric acid and potash taken away by 30,000 plants of tobacco, including stems and roots, was equal to 212,488 pounds of stable manure. But as only the leaves are required for market, the stems, etc., can be given back to the soil.

The leaves of this crop weighed about 6,000 lbs. and consisted of nitrogen 274 lbs., phosphoric acid 44 lbs., potash 170 lbs., while the rest, represented by the stems and roots, consisted of nitrogen 598 lbs., phosphoric acid 184 lbs., potash 792 lbs. Consequently farmers will readily understand what great value it will be to them to turn the stems and all the rest back to the soil, as it will give them back more than three times the weight of fertilisers which the leaves have taken from the field. This is very important for the tobacco farmer, and he should plough his land immediately after harvesting so that he may use the roots, etc., as a fertilising material. He should also return the stems to the soil after he has stripped off his tobacco.

A certain amount of organic matter in the soil is quite necessary for tobacco plants; it improves the physical and chemical conditions of the soil. It enables the soil to retain water better, consequently less is necessary for the growth, and every Transvaal farmer who has had experience of the droughts of the last few years, knows what that means. Everything possible must be done to keep the organic matter in the soil, and, if it is not present, to establish it there. For producing higher classes of tobacco, this is quite necessary; it improves the texture, structure and colour of the leaf. The bad practice of continual veld burning is one cause that the fields are so destitute of this useful organic matter. The soils of the Transvaal are not rich in plant foods, and, as explained above, there is great need of humus or organic matter, so that if we continue this veld burning we will soon get rid of both.

To enrich a poor soil in humus, which means to make of it a soil fitted for tobacco, we, happily, have a good remedy at our disposal, namely, green manuring, *i.e.*, by the planting of deep rooting, fast growing leguminous crops such as cow peas velvet beans, etc., which are ploughed under before blossoming. Thousands and thousands of barren fields, sandy lands, and also clay lands, have, by *repeated green manuring*, been transferred into fields yielding sure and abundant crops. It enriches the soil, owing to the assimilation of the free nitrogen in the atmosphere, by the action of certain microbes which form the nodules which can be seen in the roots of all *leguminosæ*, as, for instance, in peas, beans, lucerne, clover, etc.

Another advantage of applying green manure after a tobacco crop is that it keeps the soil clean. To plough weeds under, before blossoming, however, is also good for this purpose; for as the proverb runs, "one year's seeding makes seven year's weeding."

To discuss the fertiliser question in more detail, would necessitate another article, which I also hope to publish in the "Journal" in the near future, with special reference to tobacco culture. On our future tobacco experiment stations special attention will be paid to this important question, which we shall try to resolve by a series of practical fertiliser experiments in different districts. Amongst the points of special interest will be: which and how much fertiliser will do best for different kinds of tobacco soils; and by which fertiliser to improve certain qualities of the different kinds of tobacco.

5. *Tobacco Curing.*—Personally, I have not seen a curing shed in the Transvaal which the farmer can have in absolute control, and I believe that this rather difficult question is not yet fully understood. It is not my intention at present to describe all methods in detail, but I will try to give a general idea of the manipulations of—

1. Air curing.
2. Green fermentation.
3. Flue or fire curing.

The air curing can be applied for almost all tobaccos, provided a special treatment is given to each kind. Therefore this will be discussed first and more fully than the last two methods, the main principles of all being practically alike.

Air Curing.—After the growing, the curing of the tobacco is the next step. For a good curing shed, five points should be considered: (*a*) aspect, (*b*) situation, (*c*) dimensions, (*d*) construction, (*e*) ventilation.

The aspect of the shed should be such that when the ventilators are open the wind will not blow directly in at the openings. When wind blows directly in at the ventilators, before colour has set, the leaves remain green instead of changing the desired colours, and, again, after the tobacco is dry, there is great danger of having broken leaves.

The situation of the curing shed depends upon the requirements of the farmer, but, other things being equal, it should be convenient to the tobacco field, and should be as much as possible sheltered by buildings or trees on the side whence the wind blows.

The dimensions of the shed will depend upon the size of the crop, but the width should never be too great for the good ventilation of all parts of the interior when filled with tobacco. The width should not exceed 20 feet, and the height should be nearly equal to the width, while the length may be as great as desired.

The construction of the curing shed will depend, to a certain extent, upon the available and most economical material for the structure. In the Transvaal, in the low veld, where generally enough timber is at hand, the frame work and sides may be made of poles cut

from native trees. In the high veld, however, walls of brick and thatched grass roofs will probably suit well, if timber should prove too expensive. Thatched roofs will secure a more equable temperature than either board or metal ones. Especially the metal roof must be strongly condemned. The writer has observed many sheds built entirely of corrugated iron, both walls and roof. The iron being a great conductor of heat, it will be easily understood that the curing process in such a shed cannot be regulated, except after green fermentation (see below). It is most important that the shed should be so constructed that the temperature and humidity can be controlled. In order to accomplish this, it should be sufficiently tight to prevent air currents when closed. The ventilators should be at frequent intervals and sufficiently large to secure any desired amount of ventilation. They should be so constructed that the opening can be regulated to any size, so that they can be quickly and tightly closed. This tight closing of a curing shed in the Transvaal is very important, in order that the air moisture in the shed can be kept in it after damp weather ; or if this is not possible, by artificially made moisture.

On this depends chiefly the controlling of the colour of tobacco, as will be seen later on. The interior framework should be so constructed with poles and cross poles that the whole space can be utilised for hanging tobacco. Strong wires may be tightly stretched and take the place of the smallest poles (see Plate CXXIX, Fig. 1). Poles sufficiently strong to support movable planks, on which the workmen stand, should be placed at intervals, sufficiently close to enable all parts of the space to be easily reached.

Two kinds of aeration or ventilation are recognised—one slow and continuous, the other rapid and periodic. The first is secured by opening the small ventilators at the bottom and top of side walls (see Plate CXXIX., Fig 3), or by opening large ventilators only slightly. At this period the leaf is at the stage of changing colour slowly, from green into yellow, then to reddish brown. To guide this slow process best, the leaf should be dried out and be moistened every 24 hours (never by water direct, which spoils the leaf). Thus, if this process can be carried out at the time of the year, before the winter has begun, at which one can still count on air moisture, it will be very much facilitated, and we see the reason at once why it is very important to have the time between sowing and harvesting as short as possible.

According to the rainfall returns for the last few years in the different districts, which indicate approximately the best time to have the tobacco in the shed, the farmers in each district ought to know the proper time for sowing and planting. With this knowledge the farmer can easily learn whether he wants early or late maturing varieties, and, consequently, make every effort possible to get what he requires. By leaving his crop as short a time as possible on the field, he also minimizes the risk from all kinds of field troubles.

So much for the slow ventilation. The rapid ventilation, on the other hand, is effected by opening the large ventilators as wide as

possible, always guarding against the direct entrance of wind, which would produce irregular and also green colours; and against sunshine, which would cause sunburn. Large ventilators may consist of ordinary doors extending from the ground to the eaves and hinged at the side, or the same form of door may be hinged at the top and open from the bottom (see Plate CXXIX., Fig. 3.) Another form consists in having the side boards of the sheds horizontal, and every other one or every third one hinged at the upper edge (see Plate CXXIX., Fig. 4), where, however, only one side board in the middle is made in this way, which is naturally not so effective by far.

Plate CXXIX., Fig. 2, shows a shed made from a frame of poles with sides and roof covered with grass. The careful construction will be noticed, making the shed practically airtight if doors are closed. This kind of shed is, of course, much better than those provided with ventilators which cannot be closed tightly, and in which the air moisture cannot be retained if desired. Especially for the Transvaal, with its dry atmosphere, this is an important question..

If the Transvaal farmers do not wish to build a more elaborate shed, where the curing can be more or less controlled, this simple grass shed, constructed as the figure shows, will be a great improvement. However, he must take care the sides are well built as well as the roof, and not have, as I have seen on even large plantations, a well-constructed grass roof with cheaply constructed sides of thin straw or reed, which cannot protect the tobacco from wind, or keep moisture in. If one wishes to improve this shed (Fig. 2, Plate CXXIX.) easily and simply, a few chimneys might be placed on top of the roof to lead off the bad air. Such chimneys should, of course, be made so that they can be opened and closed as desired.

To summarize: No iron roofs or sides should be used except after green fermentation has taken place. Well constructed grass roofs, which could be provided with regulating chimneys on top, will answer every purpose. Use wooden or brick walls with ventilators for slow and rapid ventilation. Sheds with open sides, or not well made, are strongly to be condemned, as well as closed sheds of iron. Sheds should be provided with openings for ventilation which the farmer can open and close as necessary, *e.g.*, at the first period of slow ventilation opening slightly, or closing in case of wind; and last, but not least, on account of keeping (or providing artificial) air moisture inside.

The filling of a curing shed should be completed as rapidly as possible, and the shed closed for the curing process, so that the tobacco in all parts will require, as far as possible, the same time and ventilation. For this reason it is advisable to limit the size of curing sheds. During the early period the curing should be affected by a slow and continuous ventilation; after the colours are obtained the ventilation may become rapid and periodic. During very hot days the sheds should be kept closed, and opened during the following night. After excessively damp weather it is also well to give more rapid ventilation on a dry day, to drive away excess of moisture, and

prevent mould. If damp weather continues for several days, it becomes necessary to build fires in the shed. Charcoal is preferable to wood for this purpose, because it produces less smoke. Care must be taken that the tobacco does not turn black for lack of sufficient air, reduction instead of oxidation taking place. The nature of the processes which take place in the curing of tobacco have not yet been fully worked out, but in a general way there is loss of water—about 80% of the green weight of the leaves, and a modification of the chlorophyll and other compounds of the leaf, and the resulting change in colour should be from green to yellow, then red and brown.

If the leaves are cured in a current of hot air, the water is quickly lost and the colour remains green, because sufficient time has not been allowed for the process which causes the colour changes to take place. If the leaves remain longer in the hot air current they may also lose their fermenting power. Even after restoration of the excessive loss of water, only a slight fermentation can be produced.

I have met several farmers who asked me how it came about that their tobacco kept the green colour, and the above explanation may be of use to them. Unripe tobacco, even with the best treatment in the curing shed, retains its green colour. There are also varieties which change their colour more easily than others; for instance, we have yellow curing varieties and dark ones, etc.

In order to facilitate the transformation of the matter in the leaves, a slow curing at first is necessary. If, however, the circulation of air is too limited or is stopped, reduction takes place and the leaves become spotted; and if no ventilation is given them, they will lose their resistance and elasticity, and finally become practically worthless.

Specific rules for the air curing of tobacco cannot be given, for much depends on the weather conditions and the character of the crop and shed. Rapid ventilation should be avoided during the early stages of curing, except for short periods after very damp spells, which may be resorted to in order to drive out the excess of moisture. High temperature and excessive humidity must be avoided.

Green Fermentation.—This is good for obtaining lighter colours and milder taste in certain kinds of tobaccos. It is good for making heavier tobaccos milder, texture will be softened, and the leaf yellows into a clear golden colour. Freshly cut plants are placed in heaps. not too high. When the tobacco begins to smell the piles have to be rebuilt at once. Heaps are built at a height of two to three feet in regular rows. Change the heaps many times, so that the leaves ferment thoroughly. It of course needs some practice to know when to rebuild, but it is very soon acquired. The process is finished when the colour of the leaves has changed into sulphur yellow. Fermentation in hot seasons for heavier leaves requires 24 to 48 hours; thinner tobacco 12 to 24 hours. In a cool season it takes a longer time. Tobacco grown in dry seasons is better suited for green fermentation. During this process, which should be conducted

Plate CXXIX.

Some Types of Air-curing Sheds.

Plate CXXX Tobacco in Bulk in Fermenting Shed (Sumatra).

under cover, the carbonic acid and other gasses produced by this fermentation should be led off, otherwise there is the danger of rot.

After the tobacco has got the yellow colour—and it is the prime object to get this yellow colour in the tobacco—then the iron shed will probably, if a good one (iron being a great conductor of heat), dry the leaf quicker and so completely that there is no time to change the yellow into brown, etc.

If one wishes, however, to get the brown colours, the tobacco could be hung in a cool grass shed, such as we referred to when discussing the question of air curing.

In America this yellowing is often done in the open. Scaffolding is used to hang the plants on. Yellowing will be effected the more readily if the plants are crowded, and will not injure the tobacco. After wilting, it will be easier to hang the plants still more thickly. In four or five days the tobacco should be taken from the scaffolding and brought into the shed for further curing. In the White Burley districts scaffolding tobacco is almost universal.*

Flue or Fire Curing.—For this purpose a special type of barn must be built. The essential points are that it should be practically air tight, and provided with two furnaces having flues leading up through the centre of the barn, giving a large heating surface. There should be at least two small ventilators on or near the top of the barn. As soon as the barn is filled with tobacco, fires should be started and the temperature raised to 90° F., where it should remain from 24 to 30 hours, during which time the tobacco becomes an uniformly bright yellow colour. The next step in curing is to raise the temperature from 90° to 120° F. during 15 to 20 hours. This process is commonly known as "fixing the colour." The temperature may be gradually raised to 120° F., at which point it should be maintained for about 48 hours. By this time the leaves should be almost, if not entirely yellow, but the stalk still green. In order to cure out the stalk the temperature can be raised to 175° F., at the rate of 5° an hour, where it should remain until the stalks are thoroughly brown. Great care should be taken during the entire process of curing not to allow the temperature to fall, for a lowering of the temperature invariably produces discolourations in some parts of the leaf. The foregoing describes the process by which, in America, the North Carolina bright yellow and Virginia tobaccos are cured. Some parts of the Transvaal as, for instance, a part of Rustenburg, Marico, and probably some other districts, indicate, more or less, that flue curing might have a future. The first thing, however, is to get a uniform crop, and always the same variety of tobacco on hand with which experimenting can be started, so as to be able to learn how to regulate everything in detail, as one variety cures perhaps in a totally different manner from another.

* Messrs. Killebrew and Myrick's book—"Tobacco Leaf"—where many details of tobacco handling in America are described, and especially concerning curing, should be in possession of everybody occupied in the tobacco industry. It is published by the Orange Judd Co., New York.

The above details are only given in order to convey to the reader a general idea of this kind of curing. On the Tzaneen Estate such a shed has been built and a start has been made by curing a few sheds full. Here, also, it has been shown that the exact temperatures as followed in America do not apply for all kinds of tobaccos. Large quantities of the same tobacco being on hand, any careful and industrious man will be able to find out, after several trials with the same kind of tobacco and the same stage of ripeness, and with the guide of the American method, how to direct the temperature for obtaining the bright yellow colour for which there is such a great demand by cigarette and plug tobacco manufacturers.

6. *The Tobacco is not Sorted, is Cut First, then Sweated.*—It is almost a general custom among the Transvaal farmers, and most of the manufacturers in this country, after the tobacco has come from the curing shed, to wet the tobaccos heavily, without any sorting, put them on small piles for a certain number of hours so as to let them absorb the water, and then afterwards pass the tobacco through the cutting machine. This cut tobacco, then, is unsweated and quite wet, and in this condition heaps of this wet cut tobacco are made, and a heavy fermentation takes place during 24 to 48 hours, according to the percentage of moisture and quality of tobacco. The tobacco turns quite black, and much greater inner changes take place, chemically and otherwise. This question will also be taken up in the work of the Tobacco Division and results of our enquiries will be published. After this heavy sweating the tobacco is spread out, mostly on sails, in the open air so as to get rid of the superfluous moisture, which would otherwise spoil the tobacco (see Plate CXXXII., Figs. 1 and 2). After this drying off, this tobacco is again taken in hand, put away in heaps or into boxes in order to undergo a certain after fermentation or "aging." This way of sweating and this aging process, especially if it is applied for any length of time, is one of the reasons why the Transvaal tobacco, and especially the Magaliesberg tobacco, has a milder taste and a much improved combustibility.

The packing is generally done in cloth bags, which allows the tobacco to dry much quicker, and collects the dust, so that the tobacco becomes almost pulverised, and with the sand and dust, etc., has a disagreeable result for the smoker. All the midribs have generally been left in, and if heavy cut is applied, these midribs often look like pieces of wood.

During the last few years the demand has been for lighter colour, but owing to the faulty preparation of this kind, as will be seen hereunder, the old dark-prepared tobacco was, of course, mostly preferred. I have seen manufacturers who expected tobacco to retain its lighter colour by dipping it slightly in water and then, after passing it through the cutting machine, have the tobacco dried and packed practically without any sweating. Tobacco treated in this manner will keep its colour and will look light, but will get a green and bitter taste, almost unsmokable, and consequently practically unsaleable.

As must be quite evident, the tobacco under this method of treatment is not sorted and fermented before passing through the cutting machine. With regard to the fermentation (sweating), if this is done before cutting, the tobacco could be packed almost immediately after cutting and sifting. This would provide a long cut of tobacco, not pulverised, as it is not passed through so many processes as described above, and if sifting is carried out after cutting one would practically get rid of the dust and sand. The chief difficulty of fermenting tobacco before cutting is that after the tobacco is taken from the curing shed it is in such a dry condition, owing to the dry atmosphere in this country, that there is not enough moisture in the leaf. In order that tobacco may be properly fermented, it is necessary that the requisite amount of moisture and ferments be present. The process of fermentation develops colour, gloss, elasticity, burn and aroma, and makes keeping possible. If too dry, the fermentation progresses very slowly or not at all; if too wet it progresses too rapidly and the tobacco becomes almost black, and there is danger of moulds and putrefaction. I am confident, however, that in the event of having at one's disposal a suitable room or building where atmospheric moisture could be supplied and maintained at will, the fermentation could be carried out before cutting, but before recommending this I shall endeavour to make some experiments on this point. Another advantage to be derived by the farmer or dealer from this mode of procedure is that better sorting is possible, and he will be able to sell different classes to dealers in special lines. As an example of how tobacco in leaf is fermented, especially for cigar tobacco, see Plate CXXX., where different heaps of tobacco are shown. (Note the well constructed bulks and the clean and orderly surroundings, which entail less risk of damage from diseases or by insects.) In cigar tobacco producing countries, great care is taken to conduct this process by watching carefully the temperature (by means of thermometers in the bulks) and the atmospheric moisture. The greatest difficulty in this process is to maintain, as far as possible, the light colours which are in vogue, and which are of considerably more value than others. This can be done by allowing the temperature to rise gradually. I have often been asked about details in regard to fermentations of cigar tobacco, and, therefore, add a few words: To conduct these manipulations well, there is absolute need of a practically airtight building in which moisture and temperature can be regulated.

The fermenting house should not be so high as the curing shed, and should have windows sufficient only for lighting the interior. Air currents should be avoided and the floors should be dry. Floors of wood are, therefore, preferable, and it is often desirable to use mats beneath the fermenting piles.

The tobacco piles may be rectangular or elliptical in shape, and the height of them will depend upon the quality of the tobacco. That of superior quality should at first be fermented in piles about 2 feet in height; medium quality in piles 3 to 4 feet in height, while large piles of inferior quality and trash may be 6 feet or more in

height. The good and medium piles should be covered with burlaps or mats to prevent loss of moisture from the outside and thereby facilitate a more even temperature throughout the pile. The moisture content of the tobacco may be easily ascertained by taking a few representative hands from the pile, weighing them, then drying them in a hot-air bath at 212° F. for about two hours, and again weighing them. The loss in weight divided by the dry weight equals the percentage of moisture in the leaves.

The optimum amount of moisture for fermenting either wrapper or filler has not yet been determined for the Transvaal. In Florida certain experiments have shown that 23 to 24 per cent. was favourable. If the temperature rises 14° to 18° F. in the first day it indicates that the tobacco is too moist and contains approximately 27 per cent. With 20 per cent. of moisture the temperature rises much slower, and the slow rise in temperature indicates too small a percentage of moisture. With only 20 per cent. of moisture it was found difficult to handle and ferment the tobacco. By degrees, as the tobacco becomes drier, larger piles are made by putting two or more small piles together, in order to obtain higher temperatures. In rebuilding the piles care should be taken to avoid returning tobacco to the same position in the new pile that it occupied in the former one. It is necessary that all the hands be placed at least once in the centre of the pile. In making the successive piles larger and more compact, the maximum temperature is gradually increased from about 35° C. in the first piles to about 55° C. in the last ones. The increase in temperature must be very gradual, otherwise the quality of the tobacco is depreciated. In case of moulds, which result from the tobacco being too moist, it is necessary to thoroughly ventilate the tobacco and brush the leaves. Where the sweating is done slowly to keep the colour light, it is well to allow the tobacco to stand some time in the bulk or bale to age. This ageing is especially desirable with filler leaf, so as to develop the aroma.

Bottom, middle and top leaves should be fermented in separate piles. Bottom leaves require a lower maximum temperature than middle and top leaves. When the top leaves are to be used for filler purposes the maximum temperature may be increased from 5° to 10° C.

Before fermenting, the tobacco should be roughly graded into wrappers and fillers. The tobacco should then be tied into hands and built into piles by laying the hands straight and even, with butts to the outside. The size of the piles may vary according to the amount of tobacco in hand. It is difficult, however, to successfully ferment a small quantity, and the operation should not be undertaken with amounts less than 1,000 lbs. A convenient size for the fermenting piles is 5 to 6 feet wide, 10 to 12 feet long, and 4 to 8 feet high. In building the pile it is advisable to start the bottom with trash or some non-commercial stuff, because the bottom usually ferments very slowly. Excessive pressure should be avoided in the early stages, and

the hands be simply laid on the pile from the outside and gently pressed. Piles built in this way settle considerably, so that, after twenty-four hours, more tobacco may be put on if thought desirable. When completed it is advisable to cover the piles with burlap in order to protect them from drying out.

In order to ascertain the temperature of the piles, bamboo, wooden, or metal tubes are placed in the piles when they are built, one end being at the centre of the pile and the other reaching to the circumference. If the piles are large, two or three of these tubes may be used, one near the bottom, one near the middle, and another near the top. Ordinary chemical thermometers are inserted into the tubes and may be quickly removed and read at any time. The outer ends of the tubes should be closed with corks or cotton to prevent cooling of the interior.

The bulk is watched very closely, and as the temperature rises it is torn down, each hand of tobacco is taken up and shaken thoroughly to dry it a little, to cool it slightly, and to open the leaves so that they will not stick together. Before the sweat is completed the bulk is pulled down and built up eight or ten times, according to the condition of the tobacco. It is impossible, even for an expert curer, to give explicit directions as to when the bulk should be turned, as it depends entirely upon the condition of the tobacco and the temperature it attains, and these must be determined by the operator.

The temperature must rise gradually, and if it is found to be rising too rapidly, the bulk is torn down and a fresh one built up. Sometimes the bulk is not up over twenty-four hours before it is torn down again and built up afresh. If the tobacco is in high case, that is, quite moist, the bulks have to be turned over frequently in order to prevent too rapid action and to shake out the leaves which would otherwise stick together. If a bulk, as seldom happens, should dry out, it is turned over and mixed with a bulk which is in high case. The tobacco should never be sprinkled in this stage of the process to bring it into case.

The temperature of the pile is allowed to rise gradually until it occasionally reaches 180° F. The fermentation is then at its highest. From this point the temperature subsides until the fermentation is complete and the bulk attains the normal temperature of the room. This maximum temperature must not be reached too quickly, and it must be managed differently with the different tobaccos. The fermentation must be carefully controlled and not allowed to go too far with the wrapper leaf. With the filler, the further it goes and the more intense the action, the stronger and finer will the tobacco be for its purpose, if the work is judiciously done. As a matter of fact, it is not unusual to resweat the filler leaf to bring out the strong, rich properties which it is desired to develop. As the fermentation does not extend to the bottom of the pile, it is customary to put 8 or 10 inches of trash, which has already been sweated, on the bottom ;

and where bins are used a layer of trash is also put round the sides.

7. *Different Classes of Leaf Possibilities.*—I have seen bales of tobacco brought in to tobacco dealers in which all kinds of grades and classes of leaf were represented. For instance, if one looks at the coloured frontispiece, there are four grades represented. The leaves of each class were gathered from such bales and hands made of them.

No. 1 shews us a nice hand of tobacco that, by having been packed too wet, subsequently underwent a heavy sweating in the bale and turned out almost black. Even good tobacco can be spoiled so far as colour is concerned in this way. Except for the ordinary Boer tobacco, to which no classification is applied, and in which the demand is for a heavy leaf (which strength is reduced by this heavy sweating and drying afterwards), this colour is not in demand.

No. 2 is an excellent sample for cigarettes and other light tobacco purposes. This kind—the existence in the bales of this leaf proves it—can be produced especially in the light sandy, somewhat poorish soils. If the seed of this kind is well selected, kept separate, and grown and cured properly, a careful classification and grading will do the rest.

No. 3 is a sample of green tobacco either harvested unripe or cured in a shed (as described in the paragraph in this article on curing) where the tobacco during the first period of hanging in the shed dried out with the result that the changing of colour could not take place. If sweated it either remains green or turns quite black, but never gets better colours. As already shortly explained in a previous paragraph this green leaf can and ought to be avoided.

No. 4 is a sample for light brown tobacco purposes, and there is also a great demand for this kind.

These four figures in the Coloured Plate teach us also that classifications of the crop in different grades is necessary for the farmer, as it enables him to sell different kinds to different dealers, according to their requirements, and, naturally, dealers will be prepared to pay the farmer a better price if they can get from him exactly what they want.

In some localities attempts have been made to grow cigar tobacco suitable for filler and binder. It is still too early to discuss this matter fully, but there are indications that, with special treatment, a suitable binder and filler will be produced in certain portions of certain districts. I believe this to be quite possible, for I have seen tobacco hands containing leaves which possess many of the most important wrapper characteristics, *i.e.*, good burning power, elasticity, light veins and body and good colour, I must say, however, that these qualities have been produced only in a very small proportion, and purely by accident—the grower having had no intention of raising wrapper tobacco.

I am, therefore, confident that by application of scientific methods of treatment the time is not far distant when a cigar industry can be established in this country in which a large amount of local raw material can be used. At the present time, we still have to use an imported wrapper for covering the cigar, as well as a large amount of filler to bring out the flavour. The Transvaal filler tobacco could be improved at once even without taking into consideration the seed question and field and curing shed treatment, and this could be brought about by a well conducted fermenting process and the preparation of the filler in the factory in the Cuban instead of the European style.

I am glad to be able to state that the first attempts in the direction of the improvement of Transvaal wrapper will be made in the near future. and I am confident that the use of cheese cloth as a covering for the tobacco field will prove of great value as a set-off to the dry atmosphere of this country. I do not think it necessary to give a detailed description of the manner in which this cheese cloth should be used, as photographs Nos. 123, 124, 125, 126, and 127 clearly shew what is required to be done in this respect. The cheese cloth should cover the whole field, and should be at least nine feet above the ground.

Other Illustrations.—Plate CXXVII. I have included this illustration in order to convince farmers of the careful manner in which farmers of other countries handle their tobacco from the field to the curing sheds. The poles on which the tobacco is seen strung, having been loaded in a shed on the field, are being conveyed to the permanent curing shed. Practically, not a single leaf gets damaged, and, after comparing the Transvaal manner of harvesting tobacco with that obtaining in foreign countries, I am of opinion that the farmers of the Transvaal will be interested to observe the methods followed in those countries. In the Transvaal I have seen the tobacco plants cut and almost smashed on to each other in the field and then loaded into a waggon as if they were cabbages. Under these conditions it is not astonishing that classification does not pay, for nearly all the leaves are damaged. Curing, again, under such circumstances cannot be carried out in a proper manner.

Plate CXXVIII. shews us the harvesting leaf by leaf, which has lately been adopted in Cuba. In Sumatra, however, this "leaf by leaf" harvesting is done in even a more careful manner than in Cuba. The bottom leaves are first harvested, then gradually, at intervals, the higher standing leaves up to the top of the plant. By the present Cuba method all the leaves on the one plant are harvested at the same time, consequently either the bottom leaves are too ripe or the top leaves are still unripe. It will be seen, therefore, that in Sumatra all the leaves are harvested when at a practically equal stage of ripeness. Ripening increases the percentage of nicotine and decreases the burning power.

Plate CXXXI., Figs. 1, 2 and 3.—Three leaves are here represented. Leaf No. 1, as already explained, was of great value. The planter, therefore, should do his utmost to get all the leaves of his whole crop as equal or uniform as possible, and this is why the selection and breeding of ideal types are of such vast importance in the culture of tobacco. As already stated, this subject will be fully discussed in the near future. On comparing the three leaves shown on this plate, the great need of good classification, and of planting and harvesting in time, etc., will be easily understood.

Fig 4 demonstrates what is sometimes done in order to protect the plants from the wind. In the Transvaal, I think, a good idea would be to plant a few rows of mealies as a windbreak.

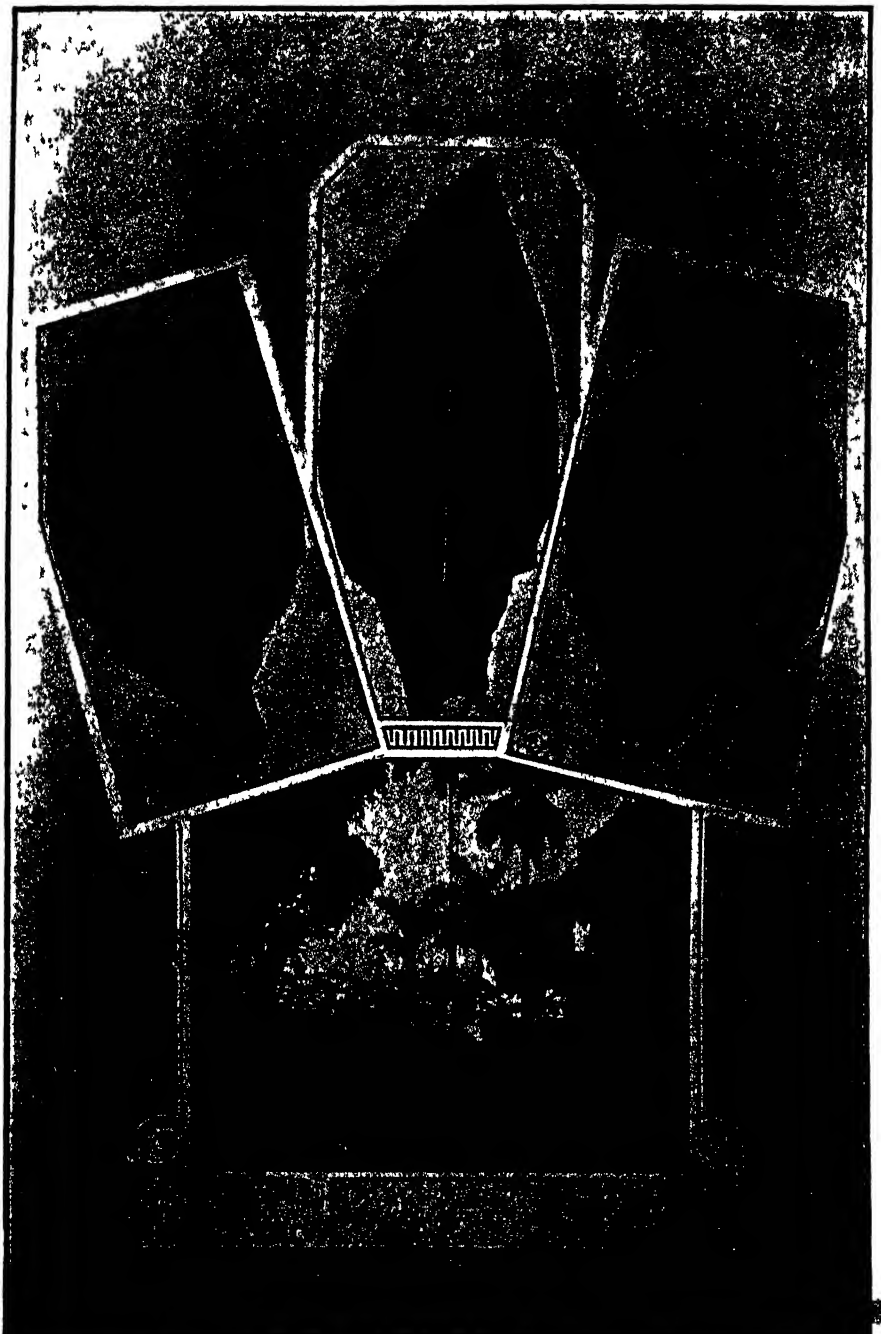


Plate CXXXI.

Fig 1.—Cigar Wrapper Leaf Note fineness and shape which gives two first-class wrappers from each side of the midrib (Cuba)

Fig 2.—Nice leaf, but note shape which gives only *one* wrapper from each side of midrib (Cuba)

Fig 3.—Similar in shape to Fig 1, but coarser and lower grade of wrapper for lower-grade cigar (Cuba)

MANURES AND THEIR APPLICATION.

By Alex. Holm,

General Manager, Experimental Farm, Potchefstroom.

UNDER whatever system of agriculture pursued, the desirability and necessity of manuring crops is to the successful farmer an established fact. Crops are grown and removed from the land, and whether sold off the farm, or consumed thereon, an equivalent return in the manurial ingredients removed from the soil has to be made. It is true that, in exceptional cases, virgin land which is capable of growing good crops for a period of years without manure is to be found in restricted areas, but the great proportion of land requires not only to be maintained in fertility, but to have that fertility increased in order that it may give profitable returns.

The aim of every agriculturist should be to grow produce of such a quality and at such a price that he will be able to compete against both internal and external competition. Manuring is a means to such an end. By the use of manures judiciously applied, the crop should be largely increased. That increase requires to bear practically only the cost of manuring, as the expenses of cultivation are approximately the same for growing either a small or a large crop; in fact it often happens that the luxuriant crop costs less for cultivation, as weeding and similar operations are less necessary. In this Colony the cost of manuring is, as a rule, relatively high, since manures have generally to be transported over long distances before reaching the users. Artificial manures have in the main to be imported, though there is some prospect of useful manurial deposits being worked in the Colony when a steady demand for the supply arises. The production of kraal or farmyard manure on most farms is comparatively small owing to the system of stock-farming pursued, and, at the present time, to the paucity of stock of all descriptions on most farms. This form of manure is not, therefore, available for the manuring of considerable areas of land. The application of manures is consequently a matter which calls for discretion and judgment on the part of the farmer. The character and condition of the soil, the kind of crop, the rotation of cropping, as well as the type of the manure itself will determine the kind of manure to be used and the manner of its application. In this country, however, as far as our present knowledge goes, the different classes of soils do not demand that varied treatment which dissimilar soils do in other countries, while the rotation of cropping is of a modified nature on account of climatic conditions.

Upon these points, however, much experimental work has yet to be done before one can speak with certainty. Nevertheless, much information can be given on the practical application of manures, and the general principles of manuring can be indicated as a guide for the manuring of different crops.

The first essential is to get the manure throughly incorporated and evenly distributed throughout the soil. It should be understood that a manure can only be used by plants when its fertilising ingredients are either in solution or can be dissolved by the sap of the root hairs of the plant. A consideration of this point illustrates the necessity for applying manures in tolerably soluble forms. This condition is sometimes brought about by treating the manure with acids, as in superphosphate and dissolved bones. In the case of raw manures, such as bone meal, guano, etc., it is essential that the manure be reduced as far as possible to a fine powder. As a general rule, the shorter the growing period and the shallower the range of the root development of a crop, the greater is the necessity that a soluble manure be applied.

Manures should be applied frequently in small applications rather than in large quantities with the object of supplying two or three successive crops. The longer a manure remains in the soil the higher is the proportion of fertilising ingredients which enter into insoluble compounds through contact with the components of the soil. Nitrogenous manures suffer great depreciation through being washed into the sub-soil, and phosphatic and potassic manures, though retained in the soil, become less effective than fresh applications of the same manures.

Classification of Manures.

Manures may be classified in various ways, *e.g.*, Natural and Artificial; Organic and Inorganic; Soluble and Insoluble; but the most satisfactory method is probably that according to their ingredients :—(1) Nitrogenous, (2) Phosphatic, (3) Potassic, (4) "General," and (5) Other Manures.

The three most essential, and, therefore, most important ingredients of plant food are nitrogen, potash and phosphoric acid. Other forms of plant food exist and are contained in such manures as lime and salt, but these are not applied so much for the plant food which they supply as for their action upon the inert fertilising matter in the soil by bringing it into such a condition as to render it available for the use of plants.

Examples of these different manures which concern this Colony are :—

Nitrogenous.—	Nitrate of Soda.
	Sulphate of Ammonia.
Phosphatic.—	Superphosphate.
	Basic Slag.

Potassic.— Kainit.
Sulphate of Potash.
General.— Farmyard Manure.
Certain Guanos.
Other Manures.—Lime.
Common Salt.
Gypsum.

Manures containing two or more constituents of plant food are :—Bone meal, steamed bone flour, dissolved bones, guanos, wood ashes and dung.

Soil Requirements.

The chemical analysis of a soil is of some assistance in determining the particular ingredients in which a soil is lacking, but the most reliable information is obtained by actual experiment with the various kinds of manures. Farmers would be well advised to make some simple experiments of this nature before embarking upon any large manuring scheme, or to follow the results of experiments on soils of a similar nature to theirs. As far as our present information goes, most Transvaal soils contain sufficient potash, but are lacking in phosphates. Nitrogen, though only present in small proportions, appears to be rendered available in sufficient quantity for ordinary crops, due probably to the great influence of climatic conditions in this country. Sandy soils and soils containing a high proportion of vegetable matter are better suited for manures in an insoluble condition than are soils of a heavier nature, *i.e.*, loams and clayey soils containing only a small proportion of sand.

Crop Requirements.

Most soils contain several tons of nitrogen, of potash and of phosphoric acid, yet applications of a few 100 lbs. per acre of manures of these kinds generally give an increase in the yield of the crop. This is due to the fact that these ingredients are not present in the soil in such a condition as to be suitable for plant food. Plants therefore, find some difficulty in obtaining the requirements for promoting their growth. In applying manures, the bulk of the fertilising ingredients is supplied in such a form as to be early available for the use of plants.

Leguminous.—These include such crops as beans, peas, lupins, clovers, lucerne, vetches, etc. To these need not be applied nitrogenous manures, as they have the power of using the nitrogen of the atmosphere. Although a great deal of nitrogen is removed in the crop, the soil is left richer in nitrogen than it was previously. Some of these crops are, therefore, the most valuable for "green manuring." These crops require potash and phosphates, particularly the former. It is probable that the soils of this country need only applications of the latter.

OTHER CROPS.

Cereals (wheat, oats, barley, rye, etc.).—These require, in particular, nitrogen and phosphates. Such highly nitrogenous manures as "nitrate of soda" and "sulphate of ammonia" have seldom been found to pay for their costly application. It is probable that, in the form of nitrates, they are quickly washed into the sub-soil by the torrential rains which are the rule in this Colony. To supply nitrogen, manure such as dung, nitrogenous guanos, bone meal, and leguminous crops used as "green manure," which yield up their nitrogen gradually as they decompose, are most to be recommended. Phosphates are essential for the development of the grain in particular, and, as previously stated, most soils in this country are deficient in phosphoric acid. The application of manures of this kind, containing also a small amount of nitrogen, is likely to give the best return.

Maize, Sorghum and Millets.—These apparently require phosphates in particular. This, together with the deficiency of this ingredient in Transvaal soils, explains why phosphatic manures give such a large increase in yield. A cheap form must, however, be obtained, or the crop, which relatively only gives a small return per acre, will not repay the expenditure. The root range of these crops is great, and they are therefore able to get sufficient nitrogen and potash in ordinary conditions. As regards nitrogen, their growing period is coincident with the development of nitrates in the soil.

ROOT CROPS.

Mangels.—This crop is a gross feeder, and requires either good land or land well manured with both nitrogen, phosphates and potash, in particular the first and the last. Dung generally gives a large increase in the yield. Potassic manures develop the production of sugar in the "roots," but, for reasons already stated, their application is not generally necessary. On this crop nitrate of soda has generally given satisfactory returns. Guano and bone meal are suitable manures, as they not only supply phosphates but also some nitrogen, which is rendered available gradually during the growth of the crop.

Sugar Beet.—If grown for stock feed, beets should be manured in the same manner as mangels, but if grown for sugar they should not be too highly manured in order that the roots may not grow too large, resulting in the production of beets of poor quality.

Turnips and Swedes.—Phosphates are the most important for these. In ordinary soils they are able to appropriate sufficient nitrogen and potash. Manures such as superphosphate, dissolved bones, phosphatic guano, basic slag, etc., are therefore recommended.

Potatoes.—As this crop only feeds in the surface soil, it is essential that plenty of food material be available. This explains why liberal manuring generally gives handsome returns on this crop, and as it is one which is one of the most valuable of farm crops, it generally pays for liberal treatment. Potash manures develop the production

of starch in the tubers and therefore improve the quality. Both nitrogen and phosphates are also essential. Dung, which supplies in particular nitrogen and potash, is recommended, together with a dressing of a phosphatic manure which is fairly soluble.

Different Manures and Amount of Application.

Dung.—Since this manure is not easily obtained, or is made only in limited quantities on farms in this country, a small dressing of from 8 to 10 tons per acre of horse and cattle manure with an ordinary amount of litter—equivalent to 3 or 4 full ox waggon loads—is recommended. One-third less of sheep manure may be applied, as it is more concentrated than the former. In this climate dung does not ferment to the same extent as it does in more moist climates, and there is very little waste by washing from the dung heap. In ordinary farming conditions in this country the dung also contains a small proportion of litter, so that there does not appear to be much necessity for keeping it for a long period before applying it to the land. Dung should be applied before the crop is sown or planted. It should be spread over the land before ploughing takes place in order that it may be thoroughly mixed throughout the soil. This will promote its decomposition, and therefore its availability for plant food. Dung is likely to give the best return on potatoes, mangels, barley (for green forage), and oat forage; and its effect may be expected to benefit two or more succeeding crops.

Guanos.—These vary very much in composition. Some contain both nitrogen and phosphoric acid in fair proportion, together with a little potash; others contain chiefly phosphoric acid. The amount which should be applied will depend upon the composition of the guano. From 300 to 400 lbs. per acre would be a fair dressing of a guano containing about 30 per cent. phosphate and 3.5 per cent. nitrogen, while about 250 lbs. per acre would be sufficient for a guano containing about 60 per cent. phosphates and 1 to 2 per cent. nitrogen. Raw Peruvian guano containing about 60-66 per cent. phosphates, 1 to 1½ per cent. nitrogen, and 1 to 2 per cent. potash is likely to prove a good general purpose manure for the soils of this Colony. Since it is a highly concentrated manure, the cost of freight would be comparatively low. Guanos are recommended for any kind of farm crop, and the different type ought to be used according as the soil is known to be poor or rich in nitrogen, and according to the kind of crop.

Bones.—They may be obtained in the raw state as bone meal, as steamed bone flour, *i.e.*, finely ground bones from which the gelatinous matter has been removed, and pure dissolved bones, *i.e.*, bones which have been treated by sulphuric acid and whose phosphates are therefore rendered more soluble. Bone manures are reliable for most kinds of farm crops. They supply both nitrogen and phosphates in well-balanced proportions. It is most essential that the bones be finely ground as nearly as possible to a powder. Too frequently, bone meal

is roughly ground, with the consequence that much of it remains for several years in the soil in an unfit condition for plant food. Steamed bone flour contains chiefly phosphates, about 60 per cent., with a small amount of nitrogen. It is therefore a manure to be recommended where phosphates are chiefly needed, and as it is, like phosphatic guano, a highly concentrated manure, the freight charges are correspondingly low per ton of phosphate. Bone meal and steamed bone flour, even though finely ground, are not such quick acting manures as superphosphate, guano, or dissolved bones. They should, therefore, be applied sometime before the crop is sown, or applied to a crop which has a long growing period. The ingredients supplied by these crops is gradually rendered available during the growth of the crop. From 300 to 400 lbs. per acre is a fair dressing of either of these bone manures.

Superphosphate is derived from treating mineral phosphates with sulphuric acid. It is purely phosphatic, and contains a higher proportion of soluble phosphate than any other manure. It is, therefore, particularly valuable as a top-dressing, and as a phosphatic manure it is particularly valuable for surface-feeding crops such as potatoes, oats, wheat and barley, which also require a fairly soluble manure. Superphosphate should not be applied to soils which are deficient in lime. A fair application would be about 400 lbs. per acre.

Basic Slag is a by-product from the manufacture of steel. It is mainly phosphatic, but contains also some caustic lime. It is often somewhat uncertain in its results. On some soils and on some crops it has given excellent results, due probably to the effect of its lime as well as its phosphate. About 500 lbs. per acre of the ordinary grade, containing about 33 per cent. phosphate, would be a sufficient dressing. This manure would probably give excellent results on those vlei lands which contain a large amount of decaying vegetable matter.

Nitrate of Soda—Supplies nitrogen only. It is an expensive manure and, for reasons already stated, it only gives satisfactory returns in this climate in exceptional cases. It should always be applied as a top-dressing, and at the rate of not more than 100 lbs. per acre on each application. For mangels, up to 200 lbs. per acre may be applied; on this crop the *sodium* which it contains may also be valuable in freeing some potash in the soil for the use of the crop. It is a manure which forces the leafy growth of crops, and might, therefore, be valuable for promoting the growth of early forage such as barley or rye. On irrigated crops it is better applied soon after an irrigation, and not immediately preceding. It should not be applied during the season of the dormant stage, but during the growing period; 100 lbs. per acre should be sufficient to apply to cereal crops.

Sulphate of Ammonia.—The same remarks apply to this manure as to nitrate of soda. Under our climatic conditions the salts of ammonia become quickly changed into nitrates, in which form the nitrogen is used by plants. It should not be applied on soils which

are deficient in lime. Nitrate of soda has generally given better results than sulphate of ammonia.

Potassic Manures.—Sulphate of Potash is, as a rule, the safest form of manure in which to apply potash. About 150 lbs. per acre would be sufficient to apply to crops like potatoes, mangels, etc. Kainit is the most common form in which to apply potash. It sometimes acts deleteriously on plant life, and, when used, it should be applied 2 or 3 months before the crop is sown. About 300 lbs. per acre would be a fair dressing of kainit. The Chief Chemist observes that the large amount of common salt, magnesium salts, etc., present in this manure are liable to do harm to our soils in which a brackish condition is so easily set up. Muriate of potash, which contains about the same proportion of potash as the sulphate form, is sometimes made use of, but is not recommended in preference to the sulphate. The chlorides which it contains often produce undesirable effects.

OTHER MANURES.

Lime.—The effect of lime on Transvaal soils is at present hardly known. Many of them are very poor in lime, and their analysis indicates that an addition of lime is essential. Liming has hitherto been an expensive operation. Now, however, cheaper forms of lime for agricultural purposes can be obtained, and these are worth the serious attention of farmers. The old practice of applying several tons of lime per acre every ten years has given place to liming at the rate of 600 to 1,000 lbs. per acre every two or three years. On some irrigated holdings lime is supplied in solution when the irrigation water comes through limestone rocks.

Salt is generally applied not so much as a direct fertiliser but as an agent for freeing potash salts for plant food and for retaining moisture in the soil. It generally gives good results in mangels, which are indigenous to the sea-shore and, therefore, a salt-loving crop. On the Potchefstroom Farm, however, applications of salt in the mangel crop have unexpectedly failed to give an increased yield. If it is desired to apply salt, a dressing of about 200 lbs. per acre would be sufficient.

Many other manures might be added to the aforesaid list, but these may be regarded as typical of those which are likely to be offered to the Transvaal farmer.

"*Green Manuring.*"—This consists in growing crops for the express purpose of ploughing them in. Their manurial effect will greatly depend upon the kind of crop. Leguminous crops are the most valuable since they supply a lot of nitrogen. In green manuring a large amount of humus is supplied to the soil, and upon the decay of this vegetable matter humic acids are formed which attack and dissolve the fertilising matter in the soil and bring it into a more suitable condition for plant food. Ordinary Transvaal soils are lacking in humus, and farmers cultivating large tracts of land would

be well advised to grow periodically a crop for this purpose. By humus the "condition" of the soil is greatly improved, the land is more easily cultivated and brought into good tilth, plants thrive better, and much of the packing of soils which is often experienced is avoided. Lupins have hitherto proved to be the most suitable crop for "green manuring" in this country. They are leguminous, very hardy and good drought resisters.

Mixing Manures.—Chemical action takes place when certain manures are mixed together, and loss of one or other of their valuable constituents may be caused.

The following may be safely mixed :—

Bone manures with basic slag, nitrate of soda, and sulphate of ammonia ;
Basic slag with nitrate of soda ;
Superphosphate with sulphate of ammonia ;
Guanos with sulphate of ammonia or nitrate of soda ;
Raw manures with mineral manures.

Mixtures of the following give rise to injurious chemical action, and should, therefore, not be made :—

Superphosphate with nitrate of soda ;
Basic slag with sulphate of ammonia ;
Superphosphate with basic slag ;
Guanos with basic slag ;
Guanos with lime ;
Dung with lime.

A farmer who knows the requirements of particular crops and the needs of his soil should purchase the simple manures and mix them as required in preference to purchasing compound manures sold as special fertilisers for particular crops. Much economy will thereby be effected, as in nearly all cases these special fertilisers are sold at prices higher than their quality warrants and higher than the respective ingredients can be secured in the simple manures.

Method of Application.

Manures may be applied previous to the sowing or planting of the crop or after the crop has "brairded," when they are called "top-dressings." The latter should always be of a fairly soluble nature, and the more insoluble the manure the longer it should be in the soil before the crop is sown. In any case the manure must be thoroughly mixed up with the soil.

Farmyard manure should, as a rule, be applied some time, say, 1 to 3 months before the crop is sown. Even during the winter season when the soil is somewhat dry it will decompose to some extent, though slowly, and no loss occurs since there is practically no rain. This is a convenient time to get this operation carried out, since it involves a good deal of labour. It will then be ready for the summer crops. For winter irrigated crops dung should be applied

and ploughed in in the autumn after heavy summer rains have ceased. If the dung is ploughed in, its intermixture with the soil will be greatly assisted, and rough coarse dung will be buried out of the way of sowers and planters. It is not advisable to apply "long dung," as it is likely to keep soils too open in this dry climate, with the result that the soil loses its moisture and is not sufficiently consolidated for the roots of plants. "Short dung," however, has the opposite effect, as it conserves moisture in a soil.

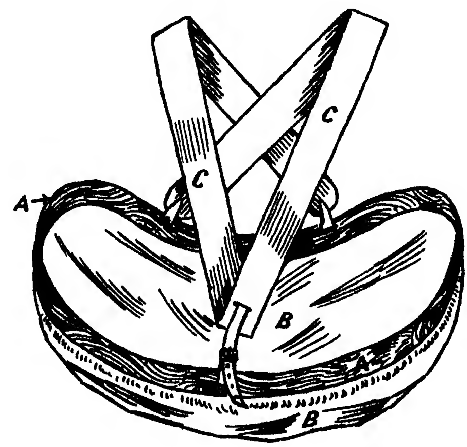
In practice the following method has proved most convenient, and is recommended :—Mark out the field in straight lines, 10 yards apart, with a plough. Off-load the manure from waggons or carts into heaps along these lines at distances of 7 yards apart. It will be found convenient to throw off a heap from each end of an ox waggon, which gives the required distance. If 15 to 20 heaps are made from each waggon load a dressing of from 8 to 10 tons per acre will be given—an average application on soils of fair quality and for ordinary crops.

The manures described respectively as nitrogenous, phosphatic or potassic are generally applied immediately preceding the sowing or planting of the crop, or after the crop has "brairded." In every case the manure should be in a finely divided condition. Some manures are inclined to become lumpy. The lumps should be broken and the whole of the manure passed through a sieve of ⅜ inch mesh. They may be sown either by hand or by a machine called a "manure distributor." If sown by hand great care should be exercised by the sower that the manure is evenly distributed and that there is no overlapping or misses at each turn.

Experienced men can sow with both hands. This method is naturally more expeditious, and the manure is generally more evenly sown than by one hand. The method of sowing with both hands can hardly be explained in writing ; suffice it to say that the swing of the arms alternately conforms to the motion of the body by the moving of each step forward. Whether in sowing with one or both hands, even distribution is secured by casting the manure high and well forward, rather than by the sower letting it fall near his feet. Larger or smaller quantities can be sown by varying (1) the length of the stride, (2) the amount held in each handful, and (3) by the extent of the "throw." Upon the kind of manure the latter will also depend.

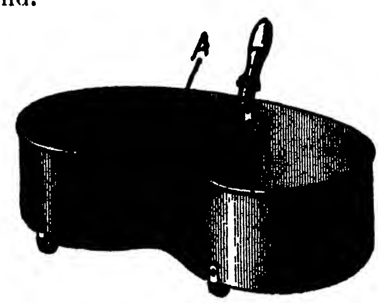
In sowing manure by hand the sower should always walk from end to end of the field in a straight line, and be guided by poles or sticks placed at intervals along this line. In no case should less than three be used, and preferably four, each pair being placed 25 to 50 yards apart at the ends. As the sower arrives at each pole he removes the stick, marks the spot with his foot, takes so many paces equal to the width of the throw and sets up the pole to guide him on the return journey.

For a sower using both hands a canvas sheet should be made —to hold about 50 lbs. This should be held immediately in front by straps over each shoulder.



FOR SOWING SEED OR MANURE WITH BOTH HANDS.
A. Wood. B. Canvas. C.—Shoulder straps.

A sower using one hand should hold the vessel containing the manure—say, 30 to 40 lbs.—under the opposite arm to that by which he sows, and against the side of his body, supported in the centre by a strap over the shoulder. The figures in the text show a canvas sowing sheet for sowing with both hands, and a sheet iron vessel for sowing with one hand.

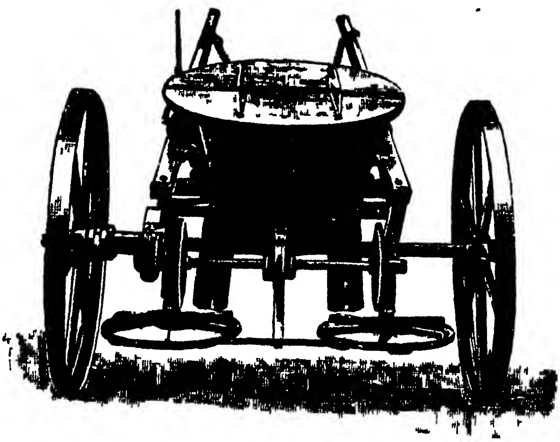


FOR SOWING SEED OR MANURE WITH ONE HAND.
Made of galvanised sheet iron.
A.— Hook to which shoulder-strap is fixed.

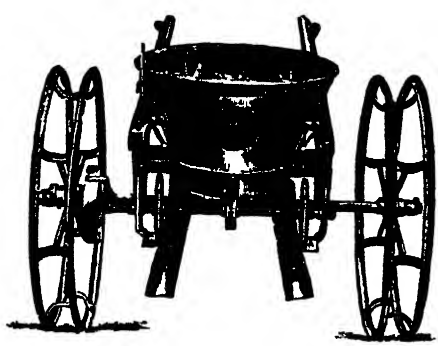
The bags of manure should be placed at each end of the field, and also in equivalent straight lines across the field if necessary. The work will be expedited by an attendant supplying the sower with the manure from the bags. In the case of the sower using both hands this is almost a necessity. A man using one hand should sow 8 to 10 acres per day at the rate of 300 lbs. per acre, and if using both hands, 14 to 16 acres per day at the same rate, with an unskilled attendant supplying him with manure.

Manure distributors are of various types of manufacture. The main types are three : (1) sowing by coulters in a combined seed and manure drill ; (2) machines of about 9 feet wide with feed roller or some similar arrangement expelling the manure evenly over this width ; (3) machines whose essential parts consist of manure receptacle with revolving discs on to which drops the manure, and by which the manure is strewn, similar in action to street watering carts (see accompanying illustration in text).

MANURE DISTRIBUTOR.



Set for broadcast



Set for sowing in drills

In (2) difficulty is often experienced with manures which are damp and consequently clog. This is considerably reduced in (3), though with it care has to be taken that the shoots feeding the discs are placed at such an angle as to cause the manure to be evenly distributed, and as the manure is thrown beyond the wheel mark greater care has to be exercised in the driving of the machine.

Sowing manure in rows in close proximity to the seed may here be mentioned. This is generally only done when for some reason it

is desired to force the young plants quickly through their early growing period. The roots of crops soon ramify throughout the soil, and the tendency for all solutions in a soil is to become equalised over the whole area. The advantages of sowing manure in proximity to the young plants are, therefore, not so great as they should apparently be.

In the potato crop a good method is to sow the manure over the ridges before the potatoes are planted. When these are split, the manure is then well mixed in the ridge where it is required.

Manures can only be well sown during calm weather. When the wind blows, the best of the manure, *i.e.*, that in its most finely divided state, is carried away over varying distances according to the strength of the wind; it is not an uncommon occurrence for manure to be drifted several hundred yards, being entirely lost or lodging where it would not give any good results. The lighter the manure and the more powdery its nature, the greater the necessity for it to be sown on a "still" day. Sometimes a delay in the sowing of the manure would cause a corresponding delay in the sowing or planting of the crop; in such a case the opportunity can often be taken of sowing the manure during the early morning and in the evening when the winds are generally light. If only a light but steady wind prevails most manures can be well sown with care. In such a case manures are best sown across the wind. If sown in the direction of the wind, the sower is inconvenienced at every turn by having the manure blown back on his face and he cannot perform good work.

Basic slag is the most difficult manure to sow under any conditions. Though heavy its particles are so finely divided that even a light wind diverts it from its proper course. In sowing this manure by hand it cannot be cast so far as other manures, and it can only be evenly spread by good sowers. Manure distributors, however, sow this manure perfectly.

Harrowing or cultivating the land should always follow an application of manure. The general practice is to apply the manure before sowing or planting the crop. The subsequent cultivations, such as cultivating, harrowing and rolling, will, therefore, cause the manure to be thoroughly incorporated in the soil. If a manure is applied as a top-dressing it should also be harrowed in with harrows of such a weight as will not damage the crop. As a rule, artificial manures should be applied on the ploughed surface and not ploughed in as in the case of dung.

Too much stress cannot be laid on the importance of good cultivation in connection with the growing of crops. Manuring is no substitute for bad cultivation; indeed, in order that manures may produce the best results it is essential that their application be accompanied by good cultivation. Aeration of the soil promotes plant growth. Exposure of the soil to the atmosphere causes oxidation to take place, and thereby plant food is produced from the natural

fertility of the soil. Good cultivation also ensures the extermination of weeds. It is false economy to manure a crop and allow the weeds to grow, since they would obviously withdraw from the crop part of the manure which had been applied, probably at considerable cost, without giving any return. Further, weeds not only use up the ingredients of plant food, but they deprive the crop of moisture. In this dry climate, in particular, every effort should be made to make the best of the gifts of nature, and, when these are aided by the application of manures, to take care that their effects may not be minimised or destroyed by bad management.

Readers are referred to Bulletin No. 1 of the Division of Chemistry on "The Composition and Use of Commercial Manures," where the chemical aspect of the subject is set forth and where the values of manures are treated.

THE EDUCATIONAL VALUE OF LIVE-STOCK EXHIBITIONS.

By J. M. Christy,

Assistant Principal Veterinary Surgeon.

THE possibilities of live stock exhibitions from an educational standpoint can hardly be estimated, and they can be discussed here only in a general way. The careers of a few individuals stand out prominently in the annals of Agriculture, and, in their cases, we can arrive at a measurable appreciation of the educational value to them of such exhibitions, but no man can tell how much the rank and file of breeders and stock raisers may have been inspired by such influences, nor can any statistician estimate the value to a country of the work of men who devote a large share of their time, energy, and money to the breeding and showing of live stock. That live stock exhibitions have an exceedingly strong hold on the attention of the public is unquestioned, and if proof were required we have but to glance over the attendance roll of some of the older established ones and at the large sums of money that are yearly offered in premiums and prizes, and the enhanced estimate of their value to the public is further emphasised by the increasing interest taken in them by people of all classes and at great distance, as instanced by the world-wide renown of the shows of the Royal Agriculture Society in England, the Royal Dublin Society in Ireland, and the American Royal and International Shows in America. The very large attendance of townspeople shows that persons of all ranks recognise the necessity and desirability of being informed concerning one of the greatest industries of the world. For convenience of description, I propose to look at these exhibitions from two standpoints, viz.: (1) value to the exhibitor; (2) value to the spectator.

(1) Value to the Exhibitor.

The public does not generally realise the fact that exhibitors usually add to their knowledge of animal form and management at each show to which they bring their animals. A carefully classified and well conducted live stock show will provide instruction not only for the spectator—almost equally important are the lessons taught the exhibitor himself. Most people think that a man who brings an animal into a show ring is beyond the necessity of acquiring knowledge of the selection and management of his animals, but while the best authorities on these subjects are undoubtedly almost always among exhibitors, the ranks of showmen frequently include some

inexperience and mediocrity. An exhibitor who goes to a show with the idea that he has nothing further to learn had better stay away. The educational value of a show to an exhibitor may be in fitting his animal for show, in competition in the ring, in interchange of views and opinions with other exhibitors and breeders and in an enlarged useful and sympathetic acquaintance, and he may also learn much from buyers, and have an opportunity of studying the requirements of the market or markets which he seeks to supply that would otherwise be denied to him.

Fitting for Shows.—When a man contemplates entering the show ring, whether in a local show or one of greater pretensions, he will be wise to send his stock in good condition. At some shows this requires that an animal be fattened almost to the danger point. It is necessary that meat-bearing animals should give good indications of their fitness for the block, and it is always more pleasing to look at a horse that has been well fed and cared than at one that is thin; besides, fat "covers a multitude of sins," even in a horse. That the requirements of a show season are extremely severe on the animals submitted to it, solely owing to the stuffing process that must be undergone, no one will deny. Many very capable breeders in all parts of the world are reluctant to show upon this account, and prefer to place their reliance upon newspaper advertising to enable them to dispose profitably of their stock. However, while admitting that some animals have been ruined for breeding purposes by this excessive feeding, many have come through unscathed by reason of inherent worth and good management, and it is this latter that the observant and careful exhibitor is afforded an opportunity of studying at a show, and in the treatment that leads up to exhibition. In bringing his cattle to this prime condition (prime from the butcher's standpoint), the exhibitor has a constant opportunity for the study of development of animal form and condition. He must calculate carefully in order to bring the herd "to edge" just at the right time, otherwise they will be "faulted," as in poor condition or over done. He must use discretion and good judgment to force them steadily, or they will become rough, uneven, patchy; and as perfect condition is very closely dependent on the quality of the animals, it follows that long before the fitting begins the breeder must have selected the individuals in his herd that would best respond to the treatment with least danger of serious injury. As the fitting advances it will be observed whether the original judgment was correct or not, whether the animal filled out here or became a trifle rough there. Much is thus learned regarding the development of the animal during growth and fattening, and the breeder learns to select animals that will develop to the best advantage, which is, next to selection in mating, the highest achievement of his art.

Competition in the Show Ring.—When the show ring is reached, the exhibitor, if a beginner, first comes into contact with two very important factors in this educational scheme. One is the competitor,

and the other is the judge. He thus has an opportunity to compare the results of his own ideas with those of others. The best opportunity a man has to learn the weak points of animals and of his own judgment is at such a time, especially if he is defeated, and he can return home with these ideas and those of his competitors and the judge to help him. The strangers he meets, the interchange of views and the friendships and friendly rivalry established, broaden his ideas and are sources of pleasure and profit to look back upon and talk over in after life.

The Study of Markets.—At the larger shows, the exhibitor comes in contact with the men who control the market, and an interchange of ideas is therefore possible, resulting in closer connection between these two forces of production. The requirements of the market must be known and understood by the breeder before he can hope for success in his work, and here he can gain his knowledge. The highly finished harness and saddle horse in the arena gives the breeder of horses higher ideals; the exhibition of dressed carcases at a fat stock show is always a drawing card and one that deeply concerns the exhibitor. It shows him the ideal carcase of the butcher's mind, and with it before him he can study to reconcile his own ideal of a fat animal on foot, a task possibly for him yet unthought of. This is a feature lacking for obvious reasons in many shows, but its usefulness is beyond question.

(2) Value to the Spectator.

The success of a show depends mainly on a creditable exhibit of animals, and a popular, judicious and skilled arrangement of classes has much to say to this. Its success as a financial undertaking depends on the public, and no matter how good its exhibits, no exhibition can last long without a good revenue from admissions unless it has the power of the Government or of some very strong and liberal corporation or society behind it. People attend shows primarily to see things, and these are usually the animals exhibited; but some shows, and those not the least successful, have another, a lighter or society side to them where people go to see and be seen. But of the vast throngs which attend exhibitions, not all are there to amuse themselves; thousands of people make use of the opportunity to study the animals in the ring. Persons in the live stock business must have instruction in methods and ideals, and they must keep in touch with the productions of the leading breeders. In addition to those who have already a more or less complete knowledge of animals, are the young men on whom the example of an outstanding winner may be forcefully impressed. The spectator finds profit, educationally, at an exhibition of live stock, principally in three ways: (1) From the ideals presented and the inspiration given; (2) in direct instruction; and (3) in the lessons conveyed on the necessity of pure breeding.

Ideals and Inspiration.—At many exhibitions is to be seen the very cream of animal production. Even at a local show a farmer may learn much from the study of the best products of his neighbours; at the larger shows he sees stock of still better breeding and in higher condition, while at a show of national scope he will find positive inspiration. The pick of the smaller shows, the animals that have been selected by a rigid judgment as worthy to compete with the best in the land, are there pitted against each other for the final contest, and many breeders who confine their exhibits to the largest shows here submit their work to the same inspection. The student, farmer, and breeder may here see the most perfect of form and quality—animals brought to the keenest edge of condition on which no expense has been spared to bring out all that is in them. The real inspiration received here does not die out with the last flutter of the winning ribbon.

Direct Instruction.—Each live stock exhibition gives many opportunities for direct instruction, especially when it is conducted on a small scale. A feature of many small shows has come to be a talk by the judge on the relative merits of some of the more prominent animals, and it is very common at the large stock shows to see a judge discussing a prize winner with a little party of spectators. These discussions are often of the greatest benefit, for it does not always happen that the spectator at the ring side is in a position to determine accurately the relative merits of the animals in the ring, as there are nearly always a number of points that show on close inspection. A discussion by a competent and fair-minded judge almost always clears away objections and results in good feeling, a very desirable sentiment at a ring side. When occasion permits, a time set apart for formal discussion of the requirements of different breeds or of the market proves to be one of the most valuable features of a show. Such instruction will crystallise and fix the ideas already gained by observation, and will bring out many indistinct and moot points, discussion of which leads to fruitful results.

A leading educational feature that cannot be overlooked in a discussion of live stock expositions is the meeting of students in contest in stock judging. The wonderful growth of instruction in animal husbandry in colleges has had a natural outlet in such trials of strength. In such contests a student will find out more about himself and about his fund of knowledge than he could otherwise expect to do in months ; he concentrates his opinions, reviews them, strengthens and fortifies those that are correct, discards those that are misleading and wrong ; he learns self-possession, develops the faculty of observation and keenness of vision at a wonderfully rapid rate, and, besides, learns to express himself correctly. I may here point out that this rapid development of the educational element in animal husbandry is as much a feature of the industry at the opening of the twentieth century as the rapid evolution of breeds was characteristic of the opening of the nineteenth century. It is certainly

true that live stock exhibitions were very common in the past, and, doubtless, our grandfathers discussed all phases of the shows with warmth and vigour ; but this idea that there is here a real field for education is of recent development, and the systematic training of young men for a foundation in the principles of stock judging has had practical and successful application within the past fourteen years only, America being the pioneer in this branch.

The Lesson of Pure Breeding.—A man may go to a show and receive inspiration and instruction, yet go home none the better for his visit if he does not carry with him the great lesson of all such exhibitions, namely, that the champions were the results of a systematic plan of breeding, not accidental productions. The value of pure breeding is first impressed on the spectator's mind. The live stock on exhibition are not the progeny of chance-bred males ; all breeding animals should be registered or be immediately eligible for registration. This is the logical outcome of years of experience. An animal cannot be trusted to produce progeny similar in form to itself unless it is from a long line of ancestors that have been bred to an accepted standard. In producing animals for the market the male should always be pure bred. The motive for the use of a half-bred sire is usually economy in the purchase price, and there is a tradition that a half-bred is more easily kept than a pure bred, but this is not borne out by careful observation. The lesson of the show points out on every hand the overwhelming importance of pure bred sires.

In a first prize exhibitor's herd may be seen the results of years of work along definite lines. The successful breeders do not switch from one breed to another, nor work inconsistently. Almost all breeders whose work has been of original and lasting value have devoted the better part of their lives to their chosen work. If the South African farmer has a fault that can compare with his neglect to provide proper winter food and shelter for his animals, it is his shiftiness and apparent carelessness in breeding. Any sort of a male is usually considered good enough. This is true of every kind of live stock from horses to chickens, and if anyone is in doubt let him look at our horses, cattle, sheep, goats and hogs, while some of the flocks of poultry that one sees are beyond description. Live stock exhibitions serve to intensify the utility of proper selection in breeding. The spectator sees there animals whose breeding for generations has been planned by one man, who has an ideal in his mind and is becoming more capable as the years go by. He notices that the herd of one man contains animals very much alike, and inquiry shows that they have been bred carefully along well defined lines, and within pretty well defined family lines, but he will also see that what in-breeding has been practised was used judiciously. On the other hand, there may be a herd that does not show the same uniformity as this one, for, although it is pure bred and contains some prize winners, it is "spotty" in breeding and lacks the uniformity of a herd bred consistently and systematically.

When the spectator thinks of his own stock at home, cross bred, mixed bred and scrubs, any kind of a male running with the droves, herds and flocks, this great lesson of the value of pure breeding is more emphatically enforced and the mind is again inspired to better work. No one forgets his first visit to a really great show. The hugeness of everything, the size of the cattle, the bigness of the hogs, the spread of back, loins and quarters of a mutton sheep, the magnificent fleece of the wool sheep, the style, action and perfect manners of the horses and the way they are turned out—these things give rise to the first impressions he receives. If one is at all a judge of stock, it does not take long to begin to look for quality and constitution, and then for breed type. When a man begins to realise that all this magnificence is the result of pure breeding, he is learning one of the greatest lessons of the show. The hope of the writer is that frequent opportunities will be given to the people of South Africa to study this lesson.

EXPERIMENTS ON MAIZE.

By Alex. Holm.
General Manager, Experimental Farm, Potchefstroom.

The following records give the results of recent experiments conducted on this crop at the Experimental Farm, Potchefstroom. The seed of most of the varieties was originally obtained from the Government Botanist, by whom it was imported.

Variety Trials.

Soil :—Brown loam, about 12 in. deep.
Subsoil :—Ironstone gravel
Previous Crop, 1905 :—Potatoes, manured with 10 tons dung and 300 lbs. steamed bone flour per acre.
No manure applied to maize.
Maize Sown :—November 21st and 22nd, 1905.
After Cultivations :—Harrowed once, horse-hoed once.
Rainfall for whole year, 18 88 inches.
Irrigation .—None.
Section A.—Grown from farm-grown seed

Variety.	Colour of Grain	Colour of Cob	Character of Grain	Size and Shape of Grain	Length of Stalk	Maturation	Number of Cobs per 2 chains length.	Weight of Grain per Imperial bushel	Yield of Grain per acre	Remarks.
					about ft. in.			lbs.	lbs.	
Vilmorin's Early Yellow	Yellow.. .	White ..	Flinty—no dent	Very small round	4 0	Very early...	106	69	1430	Grain suitable for fowl feed; cobs short, but well packed; core medium; good drought resister.
Canada Early Yellow	Yellow....	White	Flinty—no dent	Medium, roundish	4 0	Very early ..	91	66	1685	Cobs long; core thin; good drought resister.

Vilmorin's Early Yellow Longeared	Yellow....	White ..	Flinty—no dent	Medium, flat.....	4	6	Very early...	82	69	1375	Tillers; cobs very long; core thin; fair drought resister.
White Cap Dent ..	Pale yellow, with white caps	White ..	Dent	Medium, long and wedge-shaped	5	6	Early	76	—	2145	One of the best early varieties; recommended for late sowing when rains are late; cobs medium, very well packed; core medium; good drought resister.
Ninety Day	Yellow and orange	White ..	Flinty—no dent	Small, roundish .	5	0	Early	94	69	1925	Good early variety; well packed cobs, of fair size; core thin; good drought resister.
Egyptian	White, with yellow tinge	White ..	Flinty—no dent	Small, roundish..	5	0	Early	95	66	1870	Cobs medium; core rather thick; fair drought resister.
King of the Earlies	Yellow....	Red	Dent	Rather large and wedge-shaped	6	9	Medium early	93	64	2420	Highly recommended for districts where rainfall is late; cobs very well packed; core medium.
Pride of the North	Yellow....	Red	Dent	Medium, thick, flat	6	0	Medium early	86	64	2145	Useful variety; grain of good quality; cobs well packed; core medium.
White Cango	White	White ..	Flinty—no dent	Rather large, roundish	5	9	Medium early	113	66	2255	Useful variety for late districts; tillers; cobs long; core thin.
Early Mastodan ..	Pale yellow	Red	Dent	Medium, thick, flat	7	0	Medium early	74	65	1650	Cobs medium; core rather thick; fair drought resister.
White Botman ...	Pearly white	White ..	Flinty—no dent	Rather small, roundish	5	6	Medium early	107	66	1815	Not so robust as white Cango; leafy undergrowth; cobs fair size; core thin.
Early Leaming....	Yellow....	Red	Dent	Medium, wedge-shaped	7	6	Medium early	96	62	2475	Useful variety for districts with late rainfall; cobs well packed; core medium; fair drought resister.

VARIETY TRIALS.—*Section A.—Continued.*

Variety.	Colour of Grain.	Colour of Cob.	Character of Grain.	Size and Shape of Grain.	Length of Stalk.	Maturation.	Number of Cobs per 2 chains length.	Weight of Grain per Imperial bushel.	Yield of Grain per acre.	Remarks.
					about ft. in.			lbs.	lbs.	
Early Star Leaming	Yellow....	Red	Dent	Medium, thick, flat	7 6	Medium early	93	65	2695	Similar to Early Leaming, grain rather larger.
Indian Pearl	Mixed purple dark red & pearly	White ..	Flinty—no dent	Small, roundish..	5 6	Medium early	173	68	2695	Tillers very freely and very leafy; good for ensilage; cobs long; core thin; grain of high feeding quality.
Bread Mealie	Greyish white	Redish..	Floury—no dent	Large, roundish..	4 6	Medium early	85	60	1925	Tillers; useful for table purposes; cobs medium; core medium.
Un-named Early..	Yellow....	White ..	Flinty—no dent	Medium, round ..	6 6	Medium early	124	68	2475	Highly recommended for late districts and where rains are late; cobs long; core thin; very good drought resister.
Transvaal Yellow	Yellow....	White ..	Flinty—no dent	Medium, roundish	7 0	Medium late	123	66	3190	Vigorous well balanced plant; good drought resister; cobs long; core thin.
Red Cob Ensilage	White	Red	Dent	Medium, thick, flat	7 6	Medium late	93	61	2640	Vigorous leafy plant suitable for ensilage; core rather thick; cobs well packed.
Brazil Flour Corn	White	White ..	Floury—no dent	Small, round	7 0	Medium late	111	57	2090	Very suitable for ensilage; grain very white and starchy; tillers; cobs medium; core thin.

Gold Mine	Deep yellow with light yellow cob	Red ..	Slight dent	Medium, thick flat	7	9	Medium late	91	57	2585	Robust and promising variety, grain of good quality, cobs long and well packed; core medium; good drought resister.
Waterloo Extra Early	Yellow ..	Red ..	Dent ..	Medium, rather flat	6	6	Medium late	86	64	2475	Cobs well packed, core rather thick; fair drought resister.
Red Hogan	Reddish yellow	Dark Red	Dent	Rather small, thick flat	8	6	Medium late	72	—	2365	Grain of good quality, cobs well packed; core medium.
Hickory Horsetooth	White	White ..	Dent	Large, broad flat	7	6	Medium late	85	64	3355	Robust and promising variety, cobs large and well packed, core medium; good drought resister.
Hickory King, 10-rowed	White	White ..	Dent	Large, broad flat	7	6	Medium late	74	63	2585	Robust hardy variety, grain of good quality, cobs rather small, but core thin; highly recommended for most districts
Hickory King, 8-rowed,	White	White ..	Dent	Large, broad flat	7	6	Medium late	84	58	2805	Similar to above, but grain rather broader.
Boone County ...	White	White .	Dent	Medium, long flat	6	6	Medium late	80	59	1980	Affected by drought, cobs thick, well packed; core medium.
Yellow Cango	Yellow....	White ..	Flinty—no dent	Medium, roundish	6	0	Medium late	85	—	2365	Robust plant, cobs large and well packed; core medium.
Yellow Horsetooth	Golden yellow	White ..	Dent ..	Medium, rather flat	9	0	Late (very)	77	60	2915	Vigorous plant, fair drought resister, cobs long and well packed; core medium.
Burpees Golden Beauty	Yellow....	Red ...	Dent	Medium, thick flat	7	6	Late........	74	63	2365	Grain good quality, cobs medium; core medium.

VARIETY TRIALS.—Section A.—*Continued.*

Variety.	Colour of Grain.	Colour of Cob.	Character of Grain.	Size and Shape of Grain.	Length of Stalk.	Maturation.	Number of Cobs per 2 chains length.	Weight of Grain per Imperial bushel	Yield of Grain per acre.	Remarks.
					about ft in.			lbs.	lbs.	
North American .	White	White ..	Flinty, dent	Very long narrow. flat	8 6	Late........	84	—	2695	Vigorous leafy plant, useful variety, cobs thick, well packed, core medium; fair drought resister.
Golden King	Reddish yellow	White ..	Dent	Large, flat	8 6	Late (very)	86	60	2475	Robust hardy plant, good drought resister; cobs large, core medium.
Late Mastodon ...	Yellow....	Red ...	Dent	Medium, thick flat	8 6	Late	86	—	2585	Useful variety, cobs long, well packed; core medium.
Horsetooth Late White	White	White ..	Dent	Medium, slightly wedge shaped	8 0	Late	86	63	2365	Cobs rather short, but well packed, core medium; good drought resister.
Early Yellow	Yellow....	Red ...	Flinty—no dent	Small, thick flat	8 0	Late........	101	64	2420	Robust growth, cobs inclined to taper but well packed; core medium; good drought resister.
Natal White Horsetooth	White	White ..	Dent	Large, thick flat	8 6	Late (very)	77	57	2365	Robust plant, requires good rainfall, cobs long and thick; core thick.
Yellow Hogan ...	Yellow....	Red ...	Dent	Large, thick flat	8 6	Late	87	60	2915	Robust plant, grain heavy and of good quality; very good variety for early sowing; cobs long, core medium.

VARIETY TRIALS.—*Section B.*—Grown from Imported Seed.

6 Early Butler Corn	Yellow....	Red ...	Dent	Medium, rather long and wedge-shaped	6	0	Medium early	72	62	2255	Well packed cobs; core medium; fair drought resister.
Wisconsin White Dent	White	White ..	Dent	Rather long, wide and thick	5	6	Medium early	67	62	1925	A very promising variety, cobs well packed; core medium; good drought resister
Iowa Silver Mine ..	White	White ..	Dent	Medium, thick and flat	6	0	Medium early	64	54	2145	Well balanced plant with large well packed cobs: core rather thick; fair drought resister.
Drought Proof Yellow Dent	Yellow....	Red ...	Dent	Medium, thick and flat	5	6	Medium early	67	—	2145	Cobs well packed; core thick; fair drought resister.
Wood's Northern White Dent	White	White ..	Dent	Medium, short and thick	5	6	Medium early	73	61	2145	Very promising variety; cobs long and well packed; core rather thick; good drought resister.
Hundred Day Bristol	Pale yellow with white cap	Red ...	Dent	Medium, long and thick; flat	6	6	Medium early	78	63	3025	Very promising variety; cobs very well packed; core rather thin.
Champion White Pearl	White	White ..	Dent	Medium, thick; flat	7	0	Medium early	87	60	2475	Promising variety; grain of good quality; core medium; fair drought resister.
Improved Early Horsetooth	White	White ..	Dent	Medium long and flat	8	0	Medium late	78	65	2805	Suffered somewhat from drought, cobs well packed; core rather thick.
Virginian Horsetooth	White	White ..	Dent	Large, long and flat	7	6	Late........	70	61	2970	Vigorous plant: large well packed cobs; core rather thick; good variety for districts with good rainfall.
Longfellow Flint ..	Yellow....	White—no Dent	Flinty	Medium, roundish	4	0	Very early ..	86	66	1265	Tillers, cobs long, core thin.

VARIETY TRIALS.—*Section B.—Continued.*

Variety.	Colour of Grain.	Colour of Cob.	Character of Grain.	Size and Shape of Grain.	Length of Stalk.	Maturation.	Number of Cobs per 2 chains length.	Weight of Grain per Imperial bushel.	Yield of Grain per acre.	Remarks.
					about ft. in.			lbs.	lbs.	
Extra Early Huron Dent	Yellow....	Red ...	Dent	Medium, thick, flat	5 6	Very early ..	77	62	1815	Very promising early variety, recommended for late districts; cobs well packed, core medium; good drought resister.
Large Yellow Flint	Yellow....	White ..	Flinty—no dent	Rather small and roundish	3 6	Very early ..	78	69	1375	Cob long; core thin; stalk small; fair drought resister.
Compton's Early ..	Yellow....	White ..	Flinty—no dent	Medium, roundish	3 6	Very early ..	60	67	1265	A good very early variety; cobs well packed, core thin, good drought resister.
Thoroughbred White Flint	White	White ..	Flinty—no dent	Medium, roundish	4 6	Early	87	62	1815	Fair growth; cobs long, core medium. Resembles White Cango.
Sweet Fodder Corn	White	White ..	Dent	Small long, and shrivelled in appearance	3 6	Early	86	59	1210	Recommended for table use, grain sweet; core medium; cobs of medium size.
Chester County Mammoth Field Corn	Yellow....	Red ...	Dent	Medium, long and wedge-shaped	6 0	Early	87	62	2255	Very promising variety; cobs very well packed, core rather thick; good drought resister.
Eureka Field Corn	Yellow....	Red ...	Dent	Medium, rather long and wedge-shaped	7 0	Early	78	—	2035	Good early variety; cobs well packed; core medium; good drought resister.

NOTES.

Two rows of each variety were sown throughout the length of the field at three feet apart, and conditions of soil, time of sowing and cultivations were similar in all cases. As far as possible the same quantity of seed of the different varieties was sown. This was only partly successful as shown by the difference in the number of cobs. The size of the seed varies so much that it is almost impossible to get the number of plants alike in all cases, when as in this case the seed was sown with a planter. In future it is intended to cut out all extra plants in the early stages of their growth.

In comparing the yields some regard should be made to the number of cobs grown. Undoubtedly some varieties stool and produce more cobs than others, but in some cases the difference was due to the thickness of seeding.

The character of the season should be taken into account in comparing the yields. Two very severe droughts were experienced during the growing period, viz., in January and February, and it is probable that the medium-early varieties were most affected, as these droughts took place at a critical stage in their growth. Late varieties also suffered to some extent, but the early varieties did not appear to have been much affected.

With reference to the maturation period, this varies according to character of the season, but on an average the different varieties would be so ripe as to be safe from frost :—

Very Early,	in about	85	days from date	of brairding
Early,	,,	95	,,	,,
Medium Early,	,,	110	,,	,,
Medium Late,	,,	125	,,	,,
Late,	,,	140	,,	,,
Very Late,	,,	150	,,	,,

It should be observed that in Section "A" the seed sown was grown on the farm during the previous season, and in Section "B" the seed sown was imported. It is likely that the acclimatised seed would have greater vitality than the imported and, therefore would yield a heavier crop.

MAIZE.—DISTANCE TEST FOR FORAGE.

Soil :—Black loam.
Variety :—Hickory King.
Drilled :—September 28th to 30th, 1904.
Irrigated :—Once early in October.

Distance between Rows.	Quantity of Seed per acre.	Yield, lbs. per acre.
1 ft. 1½ in.	80 lbs.	15,200
1 ft. 6 in.	60 lbs.	10,293
2 ft.	45 lbs.	15,949
2 ft. 6 in.	36 lbs.	13,552
3 ft.	30 lbs.	12,467
3 ft. 6 in.	25 lbs.	11,818

Soil :—Reddish Loam.
Sown :—December 5th, 1904.
Variety :—Hickory King.

Distance between Rows.	Distance in Row.	Quantity of Seed per acre.	Yield.	
			Forage.	Grain.
		about.		
3 ft.	12 in.	12 lbs.	11,880	1,760
1ft. 6 in.	12 in.	24 lbs.	13,786	1,485
4 ft.	12 in.	8 lbs.	8,910	1,691
2 ft.	12 in.	16 lbs.	12,980	1,650
4 ft.	6 in.	16 lbs.	8,800	1,278
3 ft. 6 in.	6 in.	20 lbs.	10.685	1,603
3 ft. 6 in.	12 in.	10 lbs.	11,440	1,603
2 ft. 6 in.	12 in.	14 lbs.	12,144	1,683

In both cases the weight of green forage per acre was greatest in the close distance of planting. Under 2 feet, however, the quality of the forage was not quite so good. The stem of the plant and the lower leaves were yellow from want of sufficient light, and fewer cobs were produced, particularly in the thick seeding, where no cobs would probably have come to maturity.

Maize for Fodder—Spacing Test.

Soil :—Reddish loam.
Manure :—None.

Variety.	Sown.	Distance apart.	Seed per acre, lbs.	Green Weight. Yield per acre.
				lbs.
North American ..	Nov. 7, 1905	1 ft. 6 in.	24	9,680
" ..	"	2 ft.	18	11,880
" ..	"	2 ft. 6in.	14½	10,824
" ..	"	3 ft.	12	10,450
" ..	"	4 ft.	—	8,250
Natal White Horsetooth	Nov. 18, 1905	2 ft.	18	8,580
"	"	2 ft. 6 in.	14½	10,560
"	"	3 ft.	12	11,220
"	"	3 ft. in hills	12	8,800
"	"	3 ft. 6 in.	10½	9,990
"	"	4 ft.	9	9,405

Sorghum v. Maize.

Yield :—Green Weight.

Average yield of maize (3 varieties), 16,793 lbs. per acre.

Average yield of sorghum (variety *S. Saccharatum*), 16,133 lbs. per acre.

Manurial Experiments—Maize.

Soil :—Reddish loam, in crop first time.
Variety :—" Hickory King."
Planted :—November 15, in rows 3 feet 3 inches apart ; 10 lbs. seed per acre.

Plot.	Manure.	Lbs. per Acre.	Yield. Forage	Yield. Grain.	Increased Yield over Plot 1.	Value of Crop at 10s. per 200 lbs.	Value of Increase over Plot 1.	Cost of Manure.	Nett Gain or Loss over Plot 1.
			lbs.	lbs.		£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	No Manure ..	—	11,850	794	—	·1 19 8	—	—	—
2	Superphosphate ..	400	14,100	1,080	286	2 14 0	0 14 4	1 18 0	1 3 8 *loss.*
3	Superphosphate .. Sulphate of Potash	400 150	12,600	970	176	2 8 6	0 8 10	3 5 0	2 15 2 *loss.*
4	Superphosphate .. Sulphate of Potash Nitrate of Soda ..	400 150 200	14,775	1,054	260	2 12 8	0 13 0	4 19 0	4 6 0 *loss.*
5	Superphosphate .. Sulphate of Potash Sulphate of Ammonia	400 150 160	14,325	848	54	2 2 5	0 2 9	4 17 0	4 14 3 *loss.*
6	Guano	400	13,800	1,146	352	2 17 4	0 17 8	2 0 0	1 2 4 *loss.*
7	Guano .. .. Sulphate of Potash	400 150	16,500	1,088	294	2 14 5	0 14 9	3 7 0	2 12 3 *loss.*
8	Steamed Bone Flour	400	15,450	1,280	486	3 4 0	1 4 4	2 0 0	0 15 8 *loss.*
9	Steamed Bone Flour Sulphate of Potash	400 150	14,700	1,344	550	3 7 2	1 7 6	3 7 0	1 19 6 *loss.*
10	Nitrate of Soda ..	200	14,350	1,248	454	3 2 5	1 2 9	1 14 0	0 11 3 *loss.*
11	Sulphate of Ammonia	160	12,900	1,042	248	2 12 1	0 12 5	1 12 0	0 19 7 *loss.*
12	Sulphate of Potash	150	12,600	912	118	2 5 7	0 5 11	1 7 0	1 1 1 *loss.*

This crop was grown on " new " land, a fair average of a large area of the land in the south-western district of this Colony. Despite the fact that each application of manure gave an increase in yield over the unmanured plot, the value of the increase was in no case sufficient to pay for the cost of the manure.

An investigation into the comparative feeding values of different varieties of maize, typical of the numerous kinds grown, was carried out by the Chief Chemist. The results are fully set forth in his report in the No. 14 (January, 1906) issue of this journal, pages 359-361.

TRANSPORTING BEES.

By Frederick Sworder.

It is the generally accepted idea that in transporting bees to considerable distances, little care need be brought to bear on the undertaking, and it is thought that by simply setting the box of bees in a sheet or something of that nature, all will be well. So many points have to be considered that it will help by placing them under three heads, and considering each head in turn:—

I. Moving bees established in boxes or packing cases by road.

II. Moving swarms in frame hives by road.

III. Moving stocks established in frame hives by rail.

Occasionally a small lot of bees as described in our opening paragraph has been transported successfully, but unquestionably it was more by luck than judgment that the living cargo arrived safely at its destination.

I. *Moving bees in boxes or packing cases by road.*—Before moving a box of bees it is always best if possible to make an examination of its contents, so that we are assured that there may be no chance of mishap. One will ask how is this examination to be accomplished, and as no two cases will be exactly alike, a little common sense will have to be brought into play. The first item is to provide yourself with a smoker, and when this is well alight, blow several puffs of smoke into any available hole in the box, and the entrance. If we can exercise a little patience, after an interval of five minutes, give a few more puffs. This has the effect of frightening the inmates, which at once make for their stores of honey. and gorge themselves; they are then prepared for any emergency. While in this state we take advantage of them and can, by gentle treatment and deliberate movements, deal with them as we wish. This is the whole secret of handling and subduing bees and must always be remembered. A veil of black net gauze to protect the face will be found a great help as it will give confidence, and a pair of leather or rubber gloves (not worsted) had better be worn. A few drawing pins and a piece of wire or net gauze will be found very useful in securing any opening. If the bees are in a bottomless box, it can now be lifted for examination, and with the aid of the smoker the bees can be made to move away from the comb attachments, so that we can assure ourselves that they are built sufficiently secure to withstand the journey. It will be as well to mention that old combs travel better than newly built ones, as they are tougher. In many cases it will be found that owing to exposure to the weather, the woodwork of

the box has warped or shrunk, causing more openings than the actual entrance. These openings will be found very beneficial in assisting to give the requisite amount of ventilation and can be easily and quietly stopped with the wire gauze and drawing pins. Tacks which require to be driven in with a hammer are unsuitable, as bees resent any jarring; for while packing is proceeding we must not forget that the main entrance, or some other outlet, still remains open for the escape of the older bees, which are capable of doing most of the stinging.

During packing it should be our endeavour as far as possible to keep the bees under control (our weapon to accomplish this object being the smoker), for we may be surrounded by people, animals and poultry, all claiming our consideration. Our trolley horses, which are to assist in the operation, should by no means be brought near while preparations are proceeding. Any vehicle built with springs and travelling at a walk pace will be quite suitable for removal, and if the box is placed on a sack stuffed with shavings or grass it will ride more safely. If the box is bulky or of considerable size, a piece of cord fastened round the box will make it more convenient for handling. Select as cool an afternoon as possible in summer, commencing about 5 o'clock. Sufficient time will thus be afforded in which to complete the packing without undue haste before sunset. Do not attempt to deal with bees during darkness, for they cannot then be controlled. They always resent hurried movements; as far as possible we must avoid breathing on them. It is always best to move bees of this description the same evening, as we then practically secure all the bees, and in thus taking advantage of the cooler temperature there is less likelihood of the inmates being stifled through breaking down of combs and the amount of heat generated by them through the extra excitement. In carrying out the above details there should be little fear of mishap, and the bees may be allowed their freedom the same evening, or early the next morning, by removing the wire gauze from the entrance, but not before our horses have been taken away. When liberating the bees it will be necessary to wear a veil as they are then not in the best of tempers.

II. *Transporting swarms established in frame hives by road.*—In removing bees of this description, the facilities afforded through the introduction of the bar frame hive are comparatively easy and safe, more especially to one who is frequently called upon to execute them, for experience in this country can only be gained by constant practice; still a few hints bearing on the subject will be helpful to the novice.

If we are to be successful, many points already enumerated under heading I. must be borne in mind. Firstly, it is distinctly understood that the smoker must be used at the entrance to the hive before commencing operations, while possibly a veil of black net will have to be worn, and if the bee-keeper possesses confidence and packs his bees in the afternoon, gloves can be dispensed with. In preparing the hive of bees, procure a piece of fine wire gauze sufficiently large to cover the top of the hive. Now construct a light and well made frame-

work of wood about 2 inches wide, of the same dimensions as the top of the brood chamber; then nail the wire gauze over this frame. This gauze covering will ensure that everything is bee-proof, and still afford ample ventilation when fixed. Two strips of wood, sufficiently long and thick to take a bearing on the top of each standard frame, should be nailed to the underside of the wire gauze covering. These strips of wood will, when the covering is screwed down on top of the brood chamber, by the pressure put upon them, keep each frame of comb with the adhering bees quite steady, thus avoiding any lateral movement. While some beekeepers advocate the more complicated arrangement of inserting the bottom bar of each standard frame into a rack fixed on the floor board of the hive, the writer has found the above device quite satisfactory. The brood chamber must be made fast to the floor board. These can be connected at any convenient time by either using four of the Prideaux Fasteners, or two strips of wood about 12 inches long can be screwed perpendicularly to each side of the hive and floor girder. This simple arrangement will prevent any separation or movement of these parts during transit. The simplest and final method of securing the bees for the journey is to take a narrow strip of wire gauze to the hive and quietly fasten this at the entrance with drawing pins, after sundown. It will thus be seen that an upward current of fresh air will be admitted at the entrance, while fouled air will escape through the wire gauze covering. Should there not be a sufficient number of the standard frames to fill the brood chamber, the required amount must be inserted in order to keep any frame from moving. The roof, lift, section crate and quilts belonging to the hive must travel as separate packages.

Our hive of bees is now ready for placing on the spring trolley and should stand there on a stuffed sack, with the standard frames of combs pointing across the body of the conveyance. Bees that are established on frames of foundation that have been wired, will travel without fear of them breaking down, whereas it is not safe during the summer months to move bees on frames that are unwired. On arrival at its destination the hive should be set down on the spot it is to permanently occupy, and be shaded. The wire gauze may then be removed from the entrance early the next morning or the following evening, at the same time the covering can be unscrewed and taken off, the four strips which fasten the brood chamber to the floor girders removed, the quilts carefully arranged on the frames, and with the roof in its proper position, our undertaking is completed. Should it happen that one of the combs has broken down during the journey, it should be quietly lifted out, the bees brushed off on to the alighting board, and a new standard frame, fitted with a full sheet of brood foundation, and wired, put in its place. It should be borne in mind that no bees should be moved unless there is a sufficient quantity of honey and more than enough to last the bees during the journey.

III. *Transporting stocks of bees established in frame hives by rail.*—During recent years it has been the privilege of the writer to

pack and forward at all seasons many stocks and swarms by passenger train to various centres in the Transvaal and other Colonies. Live bees that are required to be sent by rail demand our utmost care and consideration, not only in safe packing with a ready means of handling, but explicit instructions should be given to the railway to induce them to exercise caution. To assist them in this respect two large labels, printed in bold type, should be fastened on the hive in a conspicious position with the words "Live bees with great care" and "This side up, set in a cool place." Many consignments of live bees are despatched by rail in England and other countries, and, with very few exceptions, arrive at their respective destinations quite safely, for the railway companies' servants, through the reading of similarly attached labels, exercise care. Further than this, speaking generally, the climate of England is cooler, consequently there is less risk of suffocating the inmates of the hive. In this country, especially in the summer months, elaborate preparations must be made if we wish to be successful, for it is at that particular season that bees through excitement generate more heat, while at times they may have to travel when the temperature in the shade is over 90° Fahr. If the stock of bees is what is termed strong, viz., from 20,000 to over 60,000 bees, and possibly with two crates of sections on the hive, it will be folly to endeavour to force this large number of bees into such a limited space as one brood chamber, for the whole lot will be stifled before departure to the railway station. To guard against such loss and vexation, it is essential that the stock of bees be divided into two lots; this will entail the preparation of another empty hive of the same internal dimensions as the one in which the bees are already established. Although it may be taken for granted that the railway will exercise every reasonable care, still we are not quite certain that our bees will always be set in the shade at the station while waiting loaded up on the hand truck with luggage for the approaching train, so to guard against this contingency, it is a good plan, when constructing the wire gauze covering, to fasten above it a few light strips of wood, in depth about ¾ inch, to which is tacked a piece of linen, in dimensions slightly smaller than the top of the brood chamber. This arrangement will give room for the escape of foul air, and afford protection from the direct rays of the sun.

Any still afternoon let us proceed to pack the bees for the journey by using the smoker, donning the veil, preparing the four strips of wood for sides of hives, the wire coverings and the requisite number of extra standard frames, with the two strips of wire gauze for securing the entrances, a screw-driver, a few screws and drawing pins. If the hive contains a crate of sections full of bees, this, with its living occupants, must first be removed as quietly as possible and the bees driven from it with smoke; yet another plan that will prove effectual is, to set the crate on a cloth on which has been sprinkled a few drops of carbolic acid. While the bees are returning to their hive, proceed to quietly lift out from it half the number of frames of comb with the adhering bees and place them gently in the duplicate hive; this

having been done, fill it with spare frames to prevent any movement, and screw on the gauze covering. Empty frames must also be inserted in the stock hive for the same purpose, and its gauze covering fixed on. The entrance to the duplicate hive must at once be made secure with drawing pins, otherwise the bees will return from it to the stock hive. Now remove this duplicate hive several yards away and set it in a shady place. The stock hive entrance must remain open until after sundown, when it can be closed with wire gauze, and for convenient handling stout cords should be tied tight round each hive, with the above-mentioned labels, and also labels for their destination attached. On arrival at their destination, and before the bees have been released, the stock hive must be set down where it is to permanently stand, with the duplicate hive sufficiently close for conveniently replacing the frames of comb with the adhering bees into the old home, while, if necessary, the crate of sections must be placed above the frames. Well cover up the frames with plenty of warm clothing, place the roof in position, and our operation is completed.

THE POTATO AND ITS CULTIVATION.

By Alex. Holm, General Manager, Experimental Farm, Potchefstroom.

THIS article is intended, as far as possible, to deal in a practical manner with the culture of this crop under the peculiar conditions existing in this Colony. Some of the conclusions arrived at are the result of three years' experience gained and experimental work conducted on this farm.

The potato is one of the most important articles in the diet of the Teutonic races, and statistics indicate that its consumption per head of the population is gradually increasing. It is one of the most valuable of farm crops, but its cultivation is somewhat costly. A considerable amount of labour is involved, while it is often called a speculative crop owing to the risk of loss from disease, and to the great variation which often occurs in the market price of the crop. For these reasons the area of land placed under this crop is limited. Given suitable conditions and good management, seldom does any crop of the farm give better returns over a period of years. In some countries, notably in Germany, a spirit is distilled from the starch which the potato contains.

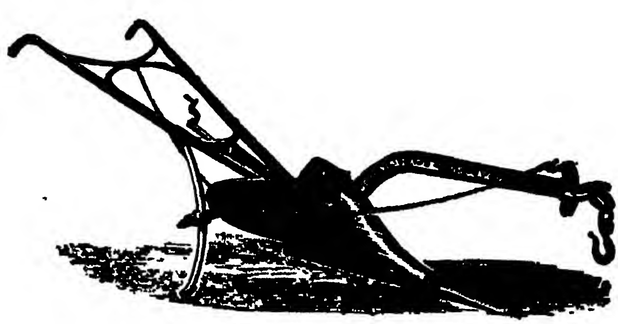
The Plant.—The potato belong to the order Solanaceæ, and is botanically known as "Solanum Tuberosum." It is here interesting to note that tobacco belongs to the same family. Chili is generally admitted to be the native country of the potato. It was introduced into Europe in the 16th Century, but it had previously been grown in America. It is grown for its tubers, which are not parts of the root but are underground stems. A great many so-called varieties exist, which vary chiefly according to the colour of the flowers, the colour of the skin of the tuber, the shade of their foliage, and their period of maturity. In a few years, varieties of potatoes quickly degenerate as regards their productive and disease-resisting powers. Consequently, it is necessary to raise new varieties possessing greater vitality. These are obtained from growing potatoes from true seed which has been cross-fertilised, but the process is a long one. Four to five years are occupied in placing a new variety in very limited quantities in the hands of the potato grower, and the work is one which is beyond the resources of the ordinary farmer. (See "Journal" of April, 1905, page 596.) The potato is a sun-loving plant, and its roots are surface feeders. These facts explain points connected with their growth, which will be referred to later.

Soil Suitable.—Well drained (naturally or otherwise) friable soils of a loamy nature, inclined to be light rather than heavy, are best suited for this crop. Potatoes require a soil rich in fertility, or, if the soil is poor, liberal manuring. The potato generally thrives well on thoroughly cultivated virgin soil.

Cultivations.—Upon these will very largely depend the success of the crop. The potato demands more cultivation than almost any other farm crop. In the first place all the cultivations must be thorough and calculated to produce a deep loose tilth. For this reason the first essential is good deep ploughing. Cross-ploughing should also be done if the land becomes stale and consolidated before the crop is planted. In this dry climate, dung should, if applied, be spread on the surface and ploughed in rather than spread directly in the furrow in which the potatoes are planted. From this point the subsequent cultivations will vary according to which of the two general methods of planting is adopted—(1) planting in a ridge made by a "Double Mould Board" plough (hereinafter called a ridging plough); (2) planting behind an ordinary plough. Which is the better plan to adopt in this country is not yet determined with certainty, and either may be preferable according to local conditions and circumstances. The points in favour of the former are numerous, but, in the latter, the only advantage, though under some conditions an important one, is that the land does not dry up so rapidly while the potato is in its early stages of growth. With the ridge system, the potatoes are planted at more even depths, consequently they come up more regularly, and they are planted in straighter lines; for these reasons they can be grubbed and hoed earlier. Again, in growing the crop with the aid of irrigation this operation is greatly facilitated as the water can be quickly passed down the ridges and the land is not sodden. During the heavy summer rains, potatoes planted on the flat run the risk of being rotted on account of the sodden condition of the land, whereas, if planted in the ridge, this risk is minimised. A practical example of this was seen in the wet summer of 1904, when, in February of that year, rain to the extent of 6.65 inches fell, resulting in the destruction of large acreages of potatoes in this district, while, on this farm, the bad effects of a superabundance of moisture were nullified through the potatoes being grown on the ridge, and a good crop was raised. Another point in favour of the ridge system is that if the crop is raised with a plough or a digger the tubers are easily unearthed. If planted on the flat, some are apt to be buried so deep in the ground that they are beyond the reach of these implements, or they are bruised in the operation of raising. Considering all these points, the writer, in the light of his experience, is of opinion that the ridge system is the best one for the crops planted in August and September and again in January and February, and grown with the assistance of irrigation. For the crop planted on "dry land" from October to December the flat system may possibly be the better one.

On the "flat" system the land should be harrowed after the first ploughing, and rolled if necessary to break up large lumps. The second ploughing should cross the first one if practicable. The potatoes are planted, in the case of a double-furrow plough taking furrows about 14 inches wide, along the side of the last furrow thrown up. This leaves room for the oxen or other draught animals to walk in the bed of the furrow without disturbing the sets. If a small single furrow plough is used, taking only a furrow 9 to 10 inches wide, then the potatoes should be similarly planted in every third furrow. If artificial manure is applied it is convenient and desirable to sow it along the furrow in which the potatoes are planted. Care should be taken to plough each furrow to an even depth. After the ploughing and the planting are completed, the field should be harrowed across the ploughing. Rolling should only be resorted to if the land is very rough, and, in every case, the harrow should follow the roller.

In the ridging system the land should be levelled and brought to a loose and fairly fine tilth by the use of cultivator and harrows, and if necessary the roller. If the land has not been recently ploughed, cultivating is desirable in order to destroy weeds and to make a loose tilth on the surface for the ridging plough to work. If rolling is performed, it will be convenient to make this the last operation before ridging, as on the rolled surface the line made by the marker of the plough is more easily traced than behind the harrow. The ridges are made by the Double Mould Board or ridging plough to which is attached a marking iron by the use of which the ridges are kept straight and at even distances apart.



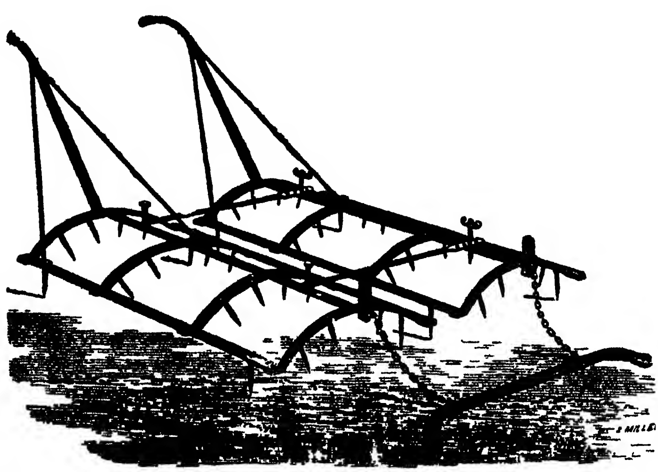
Double Mould Board or Ridging Plough with marker.

According to the width that it is desired to make the ridges so the marker is moved along its cross-bar. The "marker" always operates on the land side, and the plough is guided with its "nose" along the line made by the marker. The depth of this ridging is regulated by the two wheels at the front of the plaugh. The draught of this plough is equivalent to two strong horses, and they are better adapted for the work than mules or oxen as they can be more easily guided in a straight line. This plough should be worked at a depth of 5 to 6

inches, and care should be taken that the mould boards are set in such a manner that the soil thrown up forms an apex at the top of the ridge. If artificial manure is applied, this should be sown either along the inside of the ridges or broadcasted over the ridges.

The potatoes are planted along the bottom of the ridge and the plough then splits the ridges which covers the sets and leaves them in the bottom of the new ridge. Care should be taken to split the ridges evenly so that an equal amount of soil is thrown on either side, otherwise the potatoes will come up along the side of the ridge instead of on the top, and the subsequent cultivations will be rendered difficult. When the potatoes are being covered in by the splitting of the ridges, one of the horses should walk along the top of the ridge and the other in the bottom of the ridge. Horses can easily be taught to do this by being led for a few times. One ridging plough will open and cover in 1½ to 2 acres of land per day, the ridges being about 2 ft. 6 in. apart. Four natives should plant the potatoes as fast as this plough does the work. Much evaporation, and, therefore, drying of the soil will be prevented if the ridges are only made immediately in front of the planters and closed soon afterwards.

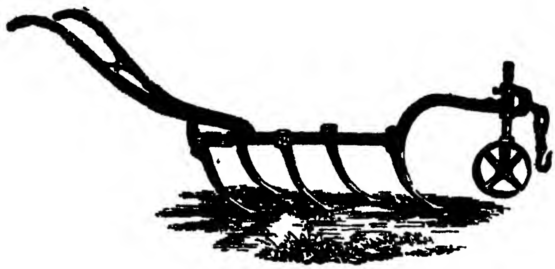
The next operation will be the harrowing of the ridges just before the potatoes begin to appear above the surface. This harrowing destroys the seedling weeds which may have germinated, and by loosening the surface soil the growth of the sprouts will be promoted. A light set of ordinary harrows may be used for this purpose, but the best ones are the saddle harrows.



Saddle Harrow

One mule or horse will pull these and should harrow 6 to 8 acres per day.

As soon as the potatoes can be seen in rows along the ridges the grubber should be used to stir up the soil between the ridges.



Potato Grubber.

It should be set to work as close as possible to the plants without pulling them out. This grubber will stir up the soil 6 to 9 inches deep, and for this work is much superior to an ordinary horse-hoe, which will only stir the soil to the depth of 2 or 3 inches.

Hand hoeing should follow to destroy the weeds around the plants. When these are from 4 to 6 inches high the potatoes should be "earthed up" with the ridging plough. As much soil as possible should be raised without covering over the plants. A second grubbing and "earthing up" is desirable, especially in the case of late varieties. This should take place about a month after the first when the haulm is about half-grown. The chief object of this deep grubbing and earthing up is to destroy weeds, to keep the soil loose, and to raise around the potato plant the maximum amount of loose soil in which the tubers can develop and the roots of the plant can ramify.

Planting.—The width of the rows and the distance apart of the sets in the rows should vary according to the period of maturity of the variety planted. Early varieties should be planted in rows about 27 inches apart, and from 12 to 15 inches in the row. The rows for late varieties should be from 30 to 33 inches, and the sets should be planted at 15 to 18 inches in the row. The amount of seed required to plant an acre will vary from 1,000 lbs. to 1,400 lbs. according to the size of the seed and the distance of the planting. In this climate with its strong sun, the greatest care should be taken to cover the sets as soon as possible after planting. If left exposed for a few hours the sun's rays would appear to destroy the protective power of the skin, causing decay among the sets and eyes, and an uneven crop is the result.

Implements are made which will plant whole sets. They generally plant two rows at a time in the bottom of the ridge. For the planting of very large acreages they can be recommended, but on an ordinary farm sufficient labour for the planting of this crop by manual labour will probably be found. Combined implements are made which perform the whole operation of making the furrow, sowing the

manure, planting the sets and covering them in one operation. Seldom, however, are the conditions of planting so perfect as to permit an implement of this kind performing all the operations satisfactorily.

The most suitable seasons for planting vary according to the climatic conditions of each district. The bulk of the potato crop is grown with the aid of irrigation, and under these conditions two crops can be grown in the course of a year, *i.e.*, (1) the crop planted in spring for summer and autumn consumption, (2) the crop planted in summer for winter and spring use. The time of the planting of the former will vary from July to September according to the date on which the last frost of the season may be expected. The potato sprouts appear above the surface in from 3 to 5 weeks after planting, the time varying according to the condition of the "seed" and the warmth of the soil. The planting should be timed so that no frosts may be expected after the potatoes appear above the surface. If a frost is indicated when they are beginning to appear above the surface, put the ridging plough through the land and cover them over slightly with soil.

The summer planting takes place from January to mid-February, and, in this case, the last date upon which they may safely be planted will depend upon when the first frost of the autumn takes place. The planting should be regulated so that the potatoes will have completed their growth before frosts set in. They will ripen in the ground after slight frosts. The period of maturity of different varieties will be referred to hereunder.

The time of planting potatoes on "dry land" will again vary according to the rainfall of the district. The soil does not require to be very moist in order to start the crop. The planting should, therefore, be "timed" so that rains may be expected soon after the sprouts appear above the surface. In most middle and high veld districts the best time would appear to be December or early in January. Definite information is still required as to whether an early or a late variety is likely to suit "dry lands" best.

Raising the Crop.—There are three methods: (1) digging with the fork, (2) using the potato plough, (3) using the potato digger.

(1) Each man digging should have one to follow him picking up the potatoes. In order to prevent the tubers being damaged by the prongs of the fork the digger should place the fork in the bottom of the ridge at the side and throw out the soil with the tubers away from the adjacent ridge. The land is then left practically level after digging, whereas if the fork is stuck into the top of the ridge the tubers are likely to be pierced and the land is left uneven.

(2) *The Potato Plough.*—A good potato plough performs efficient work. It is made on the same principle as the ridging plough, but the share is broader, and the solid mouldboards are replaced by spreading prongs, which open out the ridge and do not bruise the tubers, and attached to the sole of the plough are more spreading

prongs, which move up the tubers which may drop into the bottom of the furrow made. With this plough, care has to be taken that the tubers are not thrown too wide and covered with soil. In using this plough every alternate row is first ploughed up, and when the potatoes from them have been picked up the remaining rows are dealt with in a similar manner. Harrowing should follow to shake out any potatoes which may have been covered up, and to level the land. A potato plough, the draught of which is 2 strong horses or 4 oxen, will keep 16 pickers employed in an average crop, and they should raise 100 to 150 bags, or, say, about 2½ acres per day.

(3) *Potato Digger.*—This requires more skill in manipulation than the Potato Plough, and for that reason is not likely to be so popular in this country, where skilled labour is so expensive. Given suitable soil, and a crop well tilled and grown upon the ridge system, they perform excellent work. They are not, however, so well adapted for raising a crop planted on the flat, as in this case the tubers are apt to be buried too deeply. The best diggers are those which have a broad, sharp share, which is drawn along the bottom of the ridge, and has a series of revolving prongs which scatter the soil and tubers outwards from the ridge. A screen is placed in such a position as to prevent the tubers being thrown too wide. A potato digger requires 3 horses or 4 to 6 oxen, and the amount of labour required is about half that required for a potato plough if it only works in one direction, *i.e.*, if it returns empty; but if it works down one side of the field and up the other, approximately the same amount of labour is required as for the plough. In using the digger, the last row dug must be picked up before the one next to it is thrown out.

Marketing and Storing.—The marketing of the crop raised during the summer months demands much care and attention. At this season the potatoes should be forwarded to their destination as soon as possible after being raised. If they are kept for even a few days they will begin to "heat," and a proportion of them will decay and become soft. The riper the tubers are before being dug the better will they keep. Some varieties, on the other hand, are phenomenally bad keepers. Notice of these appears under "Varieties." If circumstances do not permit of this crop being placed upon the market immediately after being raised, the tubers should be kept in a shed in a layer not more than 18 inches deep, protected from the sun and wind, and kept turned over frequently.

The crop grown for winter and spring consumption is less difficult to handle. The best practice is to leave them in the ridges in which they are grown, and let them be raised as required. The slight covering of soil which is over them appears to be sufficient to protect them from even the severe frosts which take place on the high veld. Pitting potatoes has not been very successful on this farm, even in narrow pits with plenty of ventilation, though it is expected that potatoes would keep better in pits in the colder climate of the high veld. As soon as the warm weather of spring arrives, potatoes left

in the ridges will begin to sprout. They should, therefore, be dug immediately, and be kept in open sheds in the same manner as described above until it is desired to place them on the market. It should, however, be observed that potatoes fetch the best prices on the market when they are exhibited in a fresh condition. This state will be attained by exposing them for sale as soon as possible after they are dug.

Irrigation.—Potatoes do not require a great deal of irrigation. In the writer's experience, good crops can be grown with much less irrigation than is generally used, and the quality of the crop is likely to be better when only just sufficient water for the requirements of the crop is applied. Care must, however, be taken not to allow the crop to receive a check in its growth. The most critical period appears to be that just before the flowering stage. If potatoes receive a check then, and are irrigated later or a fall of rain takes place, new growth is started, with the result that the tubers produce "second growth." This is indicated by a distorted growth at the end of the tuber, and though this part may grow large it does not cook well, with the result that the whole sample is bad in appearance and does not satisfy the consumer. With the help of a normal rainfall three irrigations are sufficient to bring a crop of potatoes planted in August and September to maturity, and two irrigations for the one planted in January or early in February. On this farm, crops of upwards of 75 bags per acre have been grown with two irrigations—one made in July before the land was ploughed, and the other in October, after the crop had been grubbed and earthed up for the first time. A similar number of irrigations, and in some seasons only one, has been necessary to grow a full crop planted in January and early in February. Whether potatoes are grown on "dry land" or with irrigation, the importance of good cultivation cannot be exaggerated. In the former case especially it will greatly advance the growth of the crop, and in the latter wâter will be economised.

Manuring.—Since the potato is a surface feeder, and since its period of growth is comparatively short, it is essential that the land in which the crop is grown be highly fertile, or that a liberal application of manure in a fairly soluble condition be made in order to promote the growth of the crop; and since this crop costs much in the way of seed and cultivation, it is wise policy not to stint the manure. The judicious application of manure to it is generally attended by satisfactory returns.

The following are the results of manurial experiments conducted on this farm, and which are reprinted from my Annual Report. It should be explained that the soil of this farm is only about 12 inches deep, and is very poor in inherent fertility. Nevertheless, it is typical of much land in the Transvaal. It should be observed that since the calculations in the following tables were made that manure can be secured at lower rates, and that the price of potatoes has risen, both of which increase the returns from manuring.

Experiments on Potatoes.

Soil :—Reddish Loam. Sub-soil :—Ironstone Gravel.

Planted :—August 25th. Dug :—January 4th.

Variety :—Early Rose.

Irrigated thrice.

PER ACRE.

Plot.	Manure.		Yield.	Increased Yield over Plot 1.	Value of Crop @ 5/- per 100 lbs.	Value of Increase over Plot 1.	Cost of Manure.	Net Gain or Loss over Plot 1.
		lbs.	lbs.	lbs.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	No Manure		4,000	—	10 0 0	-	Nil.	—
2	Guano	400	6,240	2,240	15 12 0	5 12 0	2 17 0	gain 2 14 3
	Sulphate of Potash	150						
3	Guano	400	4,640	640	11 12 0	1 12 0	4 11 9	loss 2 19 9
	Sulphate of Potash	150						
	Nitrate of Soda	200						
4	Sulphate of Potash	150	3,360	minus 640	8 8 0	minus 1 12 0	1 7 9	loss 2 19 9
5	10 Tons (Horse) Dung		8,480	4,480	21 4 0	11 4 0	5 0 0	gain 6 4 o

Plot.	Manures: Dung 10 Tons plus		Yield.	Increase or Decrease Yield over Plot 6.	Value of Crop @ 5/- per 100 lbs.	Value of Increase over Plot 6.	Cost of Manure.	Net Gain or Loss over Plot 6.
		lbs.	lbs.	lbs.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
6	Dung (alone)		8,560		21 8 0	—	5 0 0	—
7	Guano	400	9,120	plus 560	22 16 0	plus 1 8 0	7 17 9	loss 1 9 9
	Sulphate of Potash	150						
8	Guano	400	8,480	minus 80	21 4 0	minus 4 0	9 11 9	loss 4 15 9
	Sulphate of Potash	150						
	Nitrate of Soda	200						
9	Sulphate of Potash	150	5,600	minus 2,960	14 0 0	minus 7 8 0	6 7 9	loss 8 15 9
10	Nitrade of Soda	250	8,000	minus 560	20 0 0	minus 1 8 0	6 14 0	loss 3 2 0

The crop, as a whole, was small, but it should be said that this was the first crop grown from the bare veld.

Allowing for variations in the yields due to differences in the uniformity of the land itself, the following deductions may be drawn :—

In comparing Plots 2 and 3 and 7 and 8, Nitrate of Soda, apparently, also reduced the yield, but this result may have been caused through some combination with the compounds contained in

the Sulphate of Potash. In any case it is not a manure which is likely to be beneficial on crops which have to be irrigated frequently, as the nitrate is easily washed into the sub-soil.

Dung and Guano clearly indicate that they are the most economical manures to use. The former may not be within the reach of all potato growers, so that the latter, or a manure like bone-meal, of somewhat similar composition, can be recommended as a profitable manure to apply.

Manurial Experiment on Potatoes.

Soil—Reddish Loam. Sub-soil—Ironstone Gravel.

Variety—"German Blue."

Planted February 16th.

Note.—A. 10 tons dung per acre.
B. 10 tons dung plus 1,000 lbs. ground lime per acre.
C. 1,000 lbs. ground lime per acre.
D. Artificial manures (alone).

Plot.	Artificial Manures additional to A.B.C.	YIELD		Total lbs.	
			(*a*) denotes saleable sample (*b*) .. small.		
1	No Artificial Manure	A.	a. 4,000 lbs. b. 2,400 ,,	6,400	
		B.	a. 4,800 .. b. 3,200 ,,	8,000	
		C.	a. 640 ,, b. 640 ,,	1,280	
		D.	a. — b. 320 ,,	320	
2	Sulphate of Potash, 150 lbs.	A.	a. 4,000 ,, b. 2,240 ,,	6,240	The deductions have not been carried further as the value of the crop was comparatively small. In the first place this land was recently broken up from the veld, and secondly the season was unfavourable to the production of even a fair crop.
		B.	a. 4,000 ,, b. 2,240 ,,	6,240	
		C.	a. 640 ,, b. 640 ,,	1,280	
		D.	a. — b. 800 ,,	800	
3	Superphosphate, 400 lbs.	A.	a. 4,320 ,, b. 2,560 ,,	6,880	
		B.	a. 3,840 ,, b. 2,400 ,,	6,240	
		C.	a. 2,720 ,, b. 2,400 ,,	5,120	
		D.	a. 2,240 ,, b. 1,600 ,,	3,840	
4	Superphosphate, 400 lbs. ... ... Sulphate of Potash, 150 lbs.	A.	a. 4,160 ,, b. 2,080 ,,	6,240	
		B.	a. 4,000 ,, b. 1,920 ,,	5,920	
		C.	a. 2,240 ,, b. 2,560 ,,	4,800	
		D.	a. 2,240 ,, b. 800 ,,	3,040	

In these results some discount must be allowed for variations in the quality and condition of the soil itself, because, as has already been pointed out, the crop was grown on land recently broken up from the veld.

Sulphate of Potash, except in Plot 2 D, has again been apparently responsible for a reduction in the yield—compare Plots 2 and 4 with Plots 1 and 3—but it is probable that sufficient potash was given in the application of 10 tons of dung per acre.

Superphosphate has given a considerable increase—compare Plot 1 C and D with Plot 3 C and D—but in combination with dung the increase is not so marked. It is probable that the higher yield of Plot 1 B is due to some circumstance other than addition of lime.

The application of lime has resulted in an increase of yield in all cases except when used in combination with dung, but it should be noted that, owing to unavoidable circumstances, the lime was applied in close contact with the dung.

The yield of Plot 1 D, which received no manure of any description, was practically *nil*, and this clearly indicates the futility of endeavouring to grow potatoes on "new" land of this quality without manure.

A plot which received about 400 lbs. per acre of a commercial sample of "Special Potato" manure in addition to dung gave a yield of 6,640 lbs. per acre, showing, when compared with Plot 1 A, a small return for this application.

These two experiments indicate that dung gives a large increase in the yield, and that an addition of phosphates is highly desirable. Guano and superphosphate are likely to be the best forms in which to apply phosphates. Bone meal, finely ground, will also give good results, but it should be applied after the first ploughing, and a few months before the potatoes are planted. Potash, though doubtlessly required by the crop, seems to be found in the soil in sufficient quantities.

In the light of these experiments and further experience, the writer would recommend as manures for the potato crop the following:—

On average soil which has previously borne crops of maize, forage, etc.—

> 10 tons dung per acre, and either 300 to 400 lbs. guano (quality about 4 per cent. ammonia and 35 per cent. phosphates), or 400 lbs. superphosphate (containing about 30 per cent. phosphates).

If no dung can be applied, sow—

> 400 lbs. per acre bone meal (finely ground) 2 or 3 months before planting, 200 lbs. per acre superphosphate at time of planting, and 500 to 600 lbs. ground lime per acre.

On fertile land, an application of about 300 lbs. superphosphate, or a guano rich in phosphates, would very probably give good results.

Varieties.—The following particulars, giving results of experiments conducted on this farm on different varieties of potatoes, would appear to give the necessary information required under this head:—

Potatoes—Varieties (Imported Seed).

Soil.—Reddish loam.
Manure.—10 tons dung, and 400 lbs. guano per acre.
Irrigated.—Once in April.

Variety.	Date Planted.	Yield, lbs.	Remarks.
Northern Star	Jan. 30	5,920	Late, small tubers, but numerous, good shape and firm skin.
Evergood	Jan. 26	11,520	Medium late, large tubers, good outward appearance, apt to have brown spots in centre.
Scottish Triumph ...	Jan. 26	13,920	Late, very large tubers of good shape and quality.
Empress Queen ...	Jan. 31	8,320	Medium early, tubers rather small, of fair appearance.
Sharpe's Express ...	Jan. 28	9,760	Medium early, medium sized tubers.
Sutton's Flourball ..	Jan. 31	9,440	Medium early, tubers of even and good size, pink skin, rather deep eyes.
Sutton's Discovery ...	Feb. 1	4,640	Late, weak stems, tubers of nice shape and appearance.
Duke of York	Feb. 2	7,120	Medium early, rather small tubers, slightly yellow.
Early Rose	Feb. 6	12,000	Early, pink skin, tubers of good size, not so shapely as some varieties.
Up-to-date	Jan. 21	13,360	Late, tubers of good size and numerous, a good sample.
Royal Kidney	Feb. 3	10,880	Medium early, tubers of fair size, thin skin and shallow eyes.
Sir John Llewellyn ...	Feb. 4	3,520	Very early, weak stems, tubers few, of fine shape and appearance.
English Blue	Feb. 3	10,320	Medium early, large tubers, rather unshapely with deep eyes.
Beauty of Hebron ...	Feb. 9	7,280	From home grown seed dug in January. Early, fair quality, pink skin, tubers of good size.

Potatoes—Variety Trials.

Planted.—August, 1905. Soil.—Reddish loam.
Manured with 10 tons dung per acre and 300 lbs. steamed bone flour.

Variety.	Yield per Acre.	Size.	Keeping Quality.
Sir John Llewellyn	6,720 lbs.	Medium	Good.
Duke of York	9,600 "	"	"
Early Rose	17,280 "	Large	Fair.
Sharpe's Express	11,840 "	Medium	"
Sutton's Flourball	13,766 "	Large	Excellent.
Royal Kidney	16,320 "	Medium	Fair.
English Blue	12,800 "	Large	Bad.
Empress Queen	10,880 "	"	Good.
Evergood	11,200 "	Medium	"
Eldorado	6,080 "	Large	"
Northern Star	8,320 "	Small	"
Up-to-Date	11,840 "	Large	"
Scottish Triumph	12,160 "	"	"
Sutton's Discovery	4,800 "	Small	Excellent.

Sulphate of potash evidently had a deterrent effect on the yield. This manure, generally considered to be a safe potassic manure for potatoes, was found by analysis to be of inferior quality and to contain some chlorides, which may have accounted for its failure to give a return.

They are given in rotation according to their order of ripening. The yields of the last seven, which may be termed late varieties, are not absolutely comparative with the first seven, as, being later, an extra irrigation which they did not get was needed to bring them to a full yield.

Potatoes—Variety Trials.

Soil.—Reddish loam. Planted end of January, 1906.
Crop.—1905, oats.
Manured 1906 with 10 tons dung per acre.
Manured 1905 with 300 lbs. steamed bone flour per acre.

Variety	Maturation	Colour of Flower.	Character of Growth		Yield per Acre.		
IMPORTED SEED			Leaf.	Stem	Saleable	Small.	Total.
White Hebron ...	Very early	White	Narrow	Fairly robust	7,360	320	7,680
Early Puritan ...	,,	,,	,,	,,	5,760	320	6,080
Early Rose ...	Early	,,	,,	Robust	17,920	640	18,560
Sutton's Flourball	Medium	,,	,,	Very robust	15,040	1,600	16,640
Maincrop	Late	Pink	,,	Weak	10,080	480	10,560
Eldorado	,,	White	,,	,,	1,920	1,600	3,520
Diamond ...	,,	,,	Broad	Robust	20,160	1,600	21,760
,, cut seed.		—		—	16,960	1,600	18,560
Invincible		Pink	Broad	Very robust	19,840	960	20,800
Scottish Triumph		White	,,	,,	18,560	320	18,880
Up-to-Date ...		Pink	,,	,,	21,760	320	22,080
Five Towers Brand		,,	,,	,,	28,480	640	29,120
Sutton's Discovery		No flower	Narrow	Weak	5,440	640	6,080

Some discount should be made on the yield of Five Towers as it was the outside row, and, consequently, had greater chances of development. Nevertheless, it is one of the best of the late varieties. An early frost occurred at the end of March which affected the early varieties in particular especially White Hebron and Early Puritan. This, doubtless, accounted somewhat for their comparatively small yield. After a series of trials the three varieties of potatoes, viz. :—Northern Star, Sutton's Discovery and Eldorado have been discarded as being practically worthless.

Potatoes—Variety Trials.

Soil.—Reddish loam. Planted August, 1905, raised early in January and re-planted February 8th, 1906.
Crop, 1905.—Oats.
Manured 1905 with 10 tons dung per acre.
Manured 1906 with 300 lbs. steamed bone flour per acre.

Variety.	Saleable.	Small.	Total Yield per Acre.
Home Grown Seed :—			
Sir John Llewellyn			5,760
Duke of York	5,120	320	5.440
Early Rose	—	-	8,000
Sharpe's Express	9.120	480	9,600
Sutton's Flourball	11,840	640	12,480
English Blue	9,600	320	9,920

Circumstances did not permit of these varieties being planted earlier than February 8th, and the early frost mentioned above seriously affected them. Nevertheless the yield as shown was very satisfactory.

A comprehensive cooking test of 21 different varieties gave the following results :—

Variety.	Smell.	Flavour.	Texture.	Colour when Warm.	Colour when Cold.
Sir John Llewellyn ...	Good	Good	Very floury	White	Slightly discoloured.
Snowdrop	Very good	Excellent	,,	,,	Good
Duke of York ...	Not Good	Not good	Fairly floury	Yellowish	Remains the same.
Ring Leader...	,,	Fair	Floury	Very slightly yellow	Very slightly discoloured.
Norton's Beauty ...	Fair	Not good	Fairly floury	Very white	,,
Sutton's Flourball ...	Good	Good	Very floury	,,	,,
Sutton's Discovery ...	,,	..	Floury	White	Slightly discoloured.
Imperator	Not good	Not good	Very floury	,,	Good.
Scottish Triumph ...	Good	Good	,,	Very white	Very good.
Five Towers Brand ...	Fair	Fair	,,	White	Good.
Early Rose	,,	Good	Floury	,,	Discoloured.
Up-to-Date	Good	Fairly good	Very floury	Very white	Very good.
Maincrop ...	Fairly good	Good	Foury	White	Slightly discoloured.
White Hebron ...	Fair	Good	,,	,,	Very slightly discoloured.
Diamond	Good	Very good	Very floury	,,	Discoloured.
Invincible	Not good	Fair	Fairly floury	,,	Slightly discoloured.
Eldorado	Good	Good	Floury	,,	,,
Sharpe's Express ...	Fair	Fair	,,	,,	Good.
Early Puritan ...	Fairly good	Good	Fairly floury	,,	Very good.
Conquest	Good	Very good	Fairly floury	,,	Good
English Blue ...	Fairly good	Good	,,	,,	Slightly discoloured

Cut versus Whole Seed.—Numerous experiments have been conducted to test this, but conflicting results have been obtained. Sometimes cut seed has given a larger crop than whole seed, and *vice versa.* The result, apparently, depends on the condition of the "seed" and on the relative size of the cut sets as against the whole sets. An extensive experiment is now being made to test the latter point. Sound fresh seed if cut will give good results where planted in spring

or in summer, but it is apparently not advisable to cut any tubers which are dried up or which have had the sprouts rubbed off. Only potatoes larger than a hen's egg should be cut, and care should be taken to leave two well-developed eyes on each set. The cut surfaces should be dipped in lime or sulphur, preferably 1 or 2 days before being planted. This will heal and dry up the cut surfaces, and the risk of rotting taking place in the ground will be reduced. It may here be mentioned that there are generally 3 buds to each eye, and the strongest sprout, and therefore the one which will produce the heaviest crop, is the first bud to sprout. It follows, therefore, that if the first sprouts are rubbed off the seed is "weakened."

Care and Supply of Seed.—Owing to the nature of its climate, this is one of the most difficult problems connected with potato growing in this country. Imported seed gives good results, but its high cost often prohibits a profit being made on the crop. It therefore behoves farmers to endeavour to supply "home grown" seed to a greater extent than has hitherto been done. There is considerable promise that, according as we are able to gain more experience in the handling of the potato crops grown at different seasons, we shall be able, to a considerable extent, to supplant imported seed, though we shall probably not be able to avoid the necessity of using some imported seed at certain seasons. The sum total of our experience up to the present is that:

(1) Early varieties of potatoes planted in August can, especially if their ripening is not delayed by excessive irrigation, be got fit for planting the next crop at the end of January or early in February. They should not be dug until they are ripe, *i.e.*, when the skins are firm. They should be fit for digging about Christmas, when those that are to be kept for planting should be spread in a shed in a layer not more than 18 inches deep, protected from the sun but exposed to the air, and the greater the circulation of air the better. They should be frequently turned over twice or thrice a week for the first two weeks. All soft and rotten tubers should on each occasion be thrown out. In from 3 to 4 weeks sprouting of the eyes will begin, when the "sets" may be planted. With the varieties "English Blue" and "French Blue," growers, however, inform me that they obtain the best results by planting them again immediately after digging. It is not claimed that this seed will grow quite so large a crop as imported seed, but there will be a very great saving in the cost of planting the crop. Few farmers can afford to buy imported seed for a large area, but they might be able to grow a large quantity of their own for planting the January and February crop.

(2) Early varieties, planted in December, January and February, can be kept fit for planting until late in the following September, and they would be in the best condition in August.

(3) Late varieties, planted in December and January, can be kept fit for planting until about the middle of the following November, and would be in the best condition in October.

The cycle is, therefore, almost complete. There is little difficulty in growing "locally" early varieties for planting in July to September and again in the end of January and early in February, and late varieties for planting from September to November. The incompleteness is shown in the demand for early varieties for planting from October to December, and for late varieties in December and January. Potatoes quickly deteriorate when grown under the same conditions for a few years, especially, it is said, in hot climates. It is, therefore, advisable to secure "change of seed" from other countries, in order to keep up the vitality and productive power of the varieties grown. The best practice for the farmer to adopt would apparently be to grow a small area each season from imported seed for the purpose of supplying himself with seed for the main bulk crop to be marketed.

Diseases and Pests.—Fortunately, the climatic conditions of this Colony are unfavourable to the development of that dreaded disease "Phytophtora infestans," or, as it is commonly called, "potato disease," as this disease requires a moist atmosphere to promote its existence. There is yet no record of it ever having existed in the Transvaal. The most common disease appears to be "Scab," caused by a fungus. Unfortunately, our climatic conditions are entirely favourable to its development. It would appear to be largely on the increase, and since one scabby crop infects the land for a considerable time, a great deal of damage is being done to land for potato culture. No scabby potatoes should be used for seed, and the Government Mycologist recommends that "seed" potatoes be sterilized by dipping them for one hour (in the case of apparently healthy looking seed), and for two hours (in the case of "seed" showing any signs of disease) in a solution of Formalin of the strength of 1 pint Formaldehyde (40 per cent.) to 30 gallons (Imperial) of water.

Occurrences of "Potato Blight" due to the fungus "Macrosporium solani" have been identified by the Government Mycologist. This disease attacks the leaves of the plant, and appears in the form of brownish spots. The tubers are not affected, but if the disease attacks the crop during its growing period much of the leaf surface is destroyed, and the yield is very greatly reduced. The Mycologist recommends spraying an infected crop with "Bordeaux Mixture."

The most serious pest which destroys potatoes in this country is the Potato Tuber Moth, and, judging from reports of damage done, is greatly on the increase. This moth is grey-brown in colour, about ½ inch across wings, and may be seen flitting about a potato crop. It burrows its way into the cracks in the soil and lays its eggs generally in the eye of the potato. These eggs soon hatch out into small caterpillars, which burrow into and destroy the tubers. Generally, only those tubers which are nearest the surface are damaged. The Government Mycologist recommends covering over the potatoes with as much soil as possible in the ridges, in order to prevent, as far as possible, the moth from gaining access to the tubers. In practice this is best performed by planting the rows of potatoes far enough apart, and by earthing them up late in their growth. The tubers

should not be left exposed on the land at the time of raising the crop, but should be bagged as soon as possible. The moths are continually flitting about, and, by exercising this precaution, they are prevented from laying their eggs on the tubers. Since they are more active during the night, potatoes should not be then left uncovered. For destroying the caterpillar in seed potatoes, he advises putting the tubers in a tank, and placing near the top a flat vessel containing a small quantity of carbon bisulphide. This liquid volatilises on exposure to the air, and the fumes being heavier than the atmosphere, descend through the tubers and kill the caterpillars. These caterpillars destroy, to a very large extent, the eyes of the potatoes. It is better therefore, not to plant those badly infected, and if slightly infected ones are used for planting, care should be taken to first destroy the caterpillars.

OSTRICH FARMING AS CARRIED ON AT THE PRESENT DAY.

By A. W. Douglass (C.C.).

IN writing this paper, in order not to make it too lengthy, I intend to confine myself to more or less broad lines and not go into detail.

Ostriches have now been farmed as a means of profit for some thirty-six years, and the industry to-day is on a sounder basis, and is a more profitable undertaking than at any time during its history. Farmers are more capable of judging the intrinsic value of the ostrich, and the demand for the feathers for manufacturing purposes has spread throughout most of the European countries, and has become a staple industry—doing away to a great extent with that violent fluctuation in prices that marked the earlier periods of the industry. To-day feathers may rise or fall 5 or 10 per cent., but the average from one year to another remains practically the same; and this also applies to the price of the ostrich. At the present moment, and to a lesser degree for the past two years, there has been a great demand, and very high prices have been given, and are being given, to get certain strains or types of superior feathered birds. These are strains that have established themselves, and which throw true to their parents' type. As much as £1,000 has been paid for one pair of birds of this type, and frequent sales take place at £200 and £300 a pair. This is only the natural outcome of a new industry, and, working it out on a business basis, the prices are not excessive.

I will now divide my paper under two headings:—

1. Farming Ostriches on Lucerne.
2. Ranching the Ostrich, or running the birds in camps on the natural veld.

These will embrace the two leading methods of Ostrich farming.

1. *Farming Ostriches on Lucerne.*—In order to obtain the finest feathers, and get the biggest return from the birds, this method undoubtedly comes first. The old saying, "what goes in at the mouth comes out in the bone" applies to the ostrich, except that the growth goes into the feathers. The bird must be kept in the best of condition, especially when the old quills have just been drawn, and the new growth of feathers needs an enormous amount of nourishment.

The farmer who is fortunate enough to have lucerne fields to run his ostriches on, or lucerne hay to feed them with, has really a gold mine, and I don't think there is any more profitable undertaking in the world than ostrich farming under these circumstances. The district of Oudtshoorn, which consists of the valleys of the

Grobbelaars and Oliphants rivers, is the best example of this. There the waters of these two rivers are turned out, and lucerne cultivation and ostrich farming are carried on with most astonishing results. In a distance of some seventy miles long, by a couple of miles broad, about 80,000 ostriches are farmed, with a yearly return of about £350,000, and the whole of this has been brought about within the last twelve or fifteen years. The method there consists of dividing the irrigated lands into paddocks and running the birds on the lucerne in alternate fields, watering and allowing the lucerne to mature whilst the birds are feeding down the next field—taking care to turn sufficient lucerne into hay for the winter feeding, and also for times of drought. This method ensures always having sufficient feed, as the ostrich can live, and thrives to the best advantage, on lucerne alone. If the birds have eaten off all the green lucerne, the farmer puts the hay through a chaff cutter, wets it with water, or uses it dry, and the birds eat it with just as much relish. An extraordinary thing is that the ostrich can eat as much as it likes, of either the green lucerne or lucerne hay, without any ill effects; and yet any other animal would suffer, in most cases, fatal results if given the like chance. Diseases are almost unknown in the ostrich if given sufficent food and always kept in good condition. The average number of birds that can be run on irrigated lucerne lands is generally estimated at five to the acre. The average price of an ostrich is roughly £7 to £8. The average return per bird on lucerne lands is £5. An ostrich will live to almost any age, but it is at its best at from two years old to six years old. Ostriches running on lucerne are plucked every eight months, that is to say the feathers are cut after six months' growth, but the quills (or stumps) are left another two months in the bird before they are drawn.

Oudtshoorn lies 800 feet above sea level. The ostrich needs warmth, but as long as they are well fed and protected from cold high winds, I do not think altitude will affect them much, and I do not think there is any serious drawback to their being successfully farmed almost anywhere. They are being successfully farmed now as high up as Colesberg and right down to the sea coast. At the present time almost any price is being paid for irrigation lands, which are being laid with lucerne, ultimately to carry ostriches. Lucerne lands in Oudtshoorn and in other parts of the Cape Colony are almost unobtainable, and when sales do take place, realise sums from £150 to £200 per acre; and even at this high price, when farmed with ostriches, return a high percentage of interest on the capital out-lay.

2. *Ranching the ostrich, or running the birds in camps on the natural veld.*—This method is the older and the best known of the two and more familiar to the general farmer, as given a farm and it being enclosed or fenced, unless in a very unsuitable district, ostriches may be farmed without very much trouble. In a district such as Albany, a 3,000 morgen farm will carry, roughly, from two to three hundred birds, and although the birds will not produce quite as good a feather as they will do upon lucerne, yet it is still the most lucrative

farming, and yields a much higher return than any other. The birds undergo much the same treatment as they do upon lucerne. The matured birds, or birds over eighteen months old, are turned into the different camps and allowed to find their own food, but it is the aim of nearly every farmer, at the present time, to have, by hook or by crook, an acre or two of lucerne in order to be able to rear the chicks.

The drawback to farming ostriches on the natural veld is, that in times of drought the farmer, as a rule, has heavy losses, although he may strive to feed his birds artificially by giving them mealies and prickly pear, or any other food that he may be able to obtain, yet the birds suffer in condition, and their feathers are badly grown, and as a rule they are inferior. Upon the natural veld it would be seen that one bird needs from twenty to thirty acres, whereas as shewn before, as many as five are kept upon one acre of lucerne. Against this, of course, must be put the cheapness of the un-irrigated land compared with the high price of that which is irrigated; but on the other hand, the superiority of the feather grown upon lucerne, compared to that of the feather grown on the veld must be taken into consideration. And again, the birds on lucerne are, so to speak, always under the eye of the farmer, whereas those on the veld are practically never seen, unless specially collected for plucking purposes; and as the ostrich always has a natural tendency to become wild, great trouble is experienced in collecting them into kraals or sheds, and even when got into confined spaces, they are more difficult to handle than those which are more or less brought into daily contact with the farmer or his labourers.

The general method pursued by up-to-date farmers is to select or purchase the very best birds he can possibly obtain for breeding purposes, and as a rule, each farmer will have from five to ten special camps or paddocks situated near the homestead for these birds. These birds are well fed artificially and are generally allowed to sit upon their own eggs. The use of an incubator for hatching purposes is not much in vogue now. Having hatched their nest, the chicks are as a rule taken away from the old birds when they are two or three days old, otherwise the chicks become very wild and they are difficult to catch. The chicks are then brought to the house and reared by hand upon lucerne or any other succulent food that is available. The chicks, or young birds, are as a rule herded, and fed more or less artificially until eight or nine months old, and even after that great care is needed until they are at least eighteen months old, when they are practically over the dangerous stage, and can take care of themselves.

The average return for each bird's feathers running on the natural veld is from £2 10s. to £3. The average weight of feathers taken from a bird is from twelve to sixteen ounces. This consists of the primary row, or the most valuable feathers, being white in the male bird and grey in the female. Roughly, six ounces or about sixty feathers comprise the primary row; the balance is made up of the tail feathers, and the black feathers from the male, which are drawn from

the two rows of feathers immediately next the primary feathers, and the drab feathers corresponding to the same in the female. The average price of the white feathers is about £7 per lb. ; feminas, or long grey feathers, about £4 per lb.; drabs and tails about £1 per lb. Thus the male bird always produces from a third to a half as much again as the female bird. The business of selling feathers has largely got into the hands of buyers direct from the farmers, and these buyers are mostly composed of Jews. The other way is for the farmer to consign his feathers in bulk to an agent, who has them sorted into different qualities, which are then placed on the public feather market in Port Elizabeth, Grahamstown or Capetown, and sold by an auctioneer at so much per lb., according to quality. So keen are the buyers to obtain the farmers' feathers that they will enter into a contract to buy, at so much per lb., all the feathers the farmer can produce in the next year or two years.

One of the great advantages of ostrich farming is the peculiar nature of the ostrich, that although they will drink water, it is not absolutely necessary for them to have it, and they are capable of going entirely without water for a very long period. It will easily be seen what an advantage this is in a country so afflicted by drought.

The greatest pests the ostrich farmer has are the jackal and the baboon, which break the ostrich nests, feed off the egg, catch the chicks and young birds, and enormous loss is caused through them, but by poisoning, and the erection of jackal-proof fencing, the danger is greatly overcome. The two great scourges to the ostrich farmer are that the birds in their younger stages are invariably infested with tape-worm, and still worse with *Douglassi* or wire-worm. These are overcome to a great extent by dosing the young birds with turpentine and other mixtures, and the older the bird becomes, the freer it becomes of these parasites; the reason why is as yet unknown.

The future of ostrich farming is considered by most farmers to be very bright, as the feather as a decoration is holding its own more and more, and the market for feathers is getting wider and wider. Whether feathers will ever be over-produced, in the opinion of the writer, is very doubtful, and, although the price of feathers may drop even 40% or 50% below the present price, the industry will yet be a very profitable one. Practical experience is needed in the care and management of birds, as it is only by this means that a man can become a capable ostrich farmer. Once having mastered the art of farming the bird, a more fascinating or lucrative profession would be hard to find, as the more the ostrich is studied the more fascinating it becomes.

THE VETERINARY SECTION.

VETERINARY HYGIENIC PRINCIPLES APPLICABLE TO STOCK IN SOUTH AFRICA.

By Dr. Arnold Theiler, Government Veterinary Bacteriologist,

AND

C. E. Gray, M.R.C.V.S., Principal Veterinary Surgeon.

(Continued.)

Scab.

The highly contagious character of the various types of scab and the loss sustained by stockowners directly and indirectly when the disease appears and becomes established in a flock, led to the enactment, in 1874, by the present Government of Cape Colony of a law for its suppression which superseded antiquated regulations issued during the *régime* of the Dutch Government in 1693 and 1740, which had fallen into disuse. The other Colonies followed suit at a later date, and all are now provided with Scab Laws of varying degrees of stringency, but the disease is still prevalent, and, until it is the earnest wish of the whole farming community to keep their sheep in good health, there is every likelihood that it will continue to prevail and that scab eradication will be a subject for discussion at every meeting of farmers and at every Veterinary Conference.

The disease, in the form in which it generally occurs amongst woolled sheep, in which it is most important, is not difficult to stamp out. There are numerous excellent proprietary dips on the market by which it can be readily cured, and yet a struggle of twenty years' duration in Cape Colony, in the course of which thousands of pounds have been spent, has only brought people "to that frame of mind" —to quote the words of Dr. Hutcheon—"in which they believe it is impossible to eradicate scab." Defective legal machinery may be to blame for this to some extent, it is true, but the real reason is that a large proportion of sheepowners in Cape Colony have been more prone to talk about the scab which is present in their neighbours' flocks than they have been to take off their coats and cleanse their own; otherwise the disease would have disappeared long ago.

Every progressive farmer who desires to see the country freed from the disease should remember that example is better than precept, and if he can point to his own flock as evidence of the advantages to be derived from keeping the animals clean, and can show that keeping animals clean *pays*, he is bringing forward the most powerful of all arguments in favour of getting rid of the disease; for, if self-interest will not impel his neighbour to follow his example, nothing

else will. It is, of course, true that the absence of fences and carelessness of native herds are serious handicaps, but vigilance on the part of the farmer will go far towards overcoming these disabilities. Another circumstance largely responsible for maintaining and disseminating scab infection at the present time is the practice so common amongst sheepowners on the high veld of trekking to the bush veld during the winter months, as the stock routes become infected through the carelessness of a few owners who have neglected to cleanse their sheep before trekking, and a large proportion of those using these roads pick up the infection and carry it with them to their destination. Many experienced sheep farmers maintain that this change of veld is most essential to the well-being of their flocks, but this is open to question, and in process of time, with the fencing of stock routes, the grazing *en route* of large flocks of travelling sheep will become impossible, and sheepowners will, perforce, have to make provision for the feeding of their sheep on the high veld in winter ; and when this time arrives, the problem of protecting sheep from scab infection will be a more simple one than it is to-day.

The Scab Act of the Orange River Colony is somewhat elaborate in character and makes ample provision for dealing with the disease, prescribing a period within which all sheep and goats must be dipped twice, and directing every landowner to provide himself with a dipping tank or arrange to have access to one within three months of the date of the promulgation of the Ordinance. In the manner of their administration of the Scab Regulations, the Orange River Colony have followed the example of the Cape Colony and have established a separate department for dealing with the disease, a somewhat unfortunate arrangement as, on the one hand it deprives the Colony of the assistance and advice of their Veterinary staff in suppressing the disease, and on the other, the Veterinary Department lose the help of the Stock Inspectors who are not available for dealing with other stock diseases, a circumstance which limits their usefulness considerably.

In Rhodesia, where the number of woolled sheep is comparatively small, the regulations, which are modelled on those of Cape Colony and considerably improved, give ample powers to the Veterinary staff to whom the task of dealing with outbreaks has been entrusted, but, up to the present, the question of eradicating that form of scab which is most prevalent—the sarcoptic form—has not received a great deal of attention, as most of the goats and native sheep in the Colony belong to native owners and are kept under such conditions that their successful treatment is a matter of impossibility. In a few localities, however, woolled sheep have been introduced and are doing well, and in these places they are carefully looked after.

In Cape Colony, legislation for dealing with scab was brought in in 1874, which was superseded by the Scab Act of 1886, and this was, in turn, amended by the Acts of 1888, 1894 and 1899. The present law is good, but the machinery provided for enforcing it is, in some respects, of the feeblest and most ineffective character ; and

although the responsible head of the Department and his immediate subordinates fully appreciate the importance of the work committed to their charge, the amount of good done in proportion to the amount of money spent annually is lamentably small. It is an old saying and a true one that a chain is no stronger than its weakest link, and the Cape system of administering the Scab Act is far from being an ideal one. To begin with, the work is not directly under the control of the Veterinary Department, but its most serious defect lies in the manner in which the Sheep Inspectors are appointed and paid, and it is impossible to conceive a method of selecting Inspectors which would be more likely to defeat the end which those who framed the regulations had presumably in view, as it places every progressive district in the country completely at the mercy of those districts which are indolent and indifferent. Briefly, the defect is this—the Scab Inspectors for each division are appointed on the recommendation of a Scab Board consisting of the Civil Commissioner and three members, one of whom is elected through the Divisional Council and the other two by persons whose names are on the list of Divisional Council Voters. At first sight the plan would seem to be a fairly good one, as it might appear that each district would naturally be desirous of freeing itself from the disease, and, for that reason, would select a good man who could be depended upon to attend his duties But, although this is the case in those sections of the country in which farmers realise the importance of stamping out the disease, there are, unfortunately, other districts where farmers and those who represent them are careless about keeping their flocks clean, and in which the Board display more anxiety to select a man by whom they will not be unduly troubled ; and the result is that the good which is being done in the progressive district is more than undone by want of care in the conservative one, and, in course of time, the progressive farmers ultimately lose heart and interest in the whole question. Such a system of appointing Inspectors would be fatal to the successful operation of the most perfect ordinance which was ever drawn up, as it is not to be supposed that a man whose tenure of office depends upon the goodwill of those by whom he was elected can be depended upon to perform his duties properly if the proper performance of these duties is likely to get those who appointed him into trouble for breaking the regulations. If Stock Inspectors are to carry out their work in a proper and conscientious manner they must be selected on account of their fitness to do so ; they must be paid a fair salary and must be responsible to a central authority only, by whom they should be directed and controlled ; and if the stock regulations are to be administered in an economical and sensible manner these men should not only be trained to deal with scab but should be conversant with the symptoms and *post mortem* appearances of the other proclaimed diseases, and should work hand in hand with the Government Veterinary Surgeon of the district.

In Natal and in the Transvaal the carrying out of the provisions of the Scab Regulations is left in the hands of the Veterinary

Department, and in both Colonies a clause is inserted in the laws providing for the dipping of all sheep at a certain season of the year, although it is not quite clear from the Natal law that this clause is still in operation. The Natal Act, which is much more elaborate than that in force in the Transvaal also provides for the compulsory branding of all sheep, and, for the purpose of minimising the risk of introducing infected sheep from other Colonies, it directs that all sheep brought from over the border must be dipped once even if certified by the Inspector of the district to be free from scab; but if not certified to be clean they at once become subject to the regulations applying to local infected animals. In both Colonies the laws are of such a character that they should operate in a satisfactory manner, but it behoves all stockowners to remember that, unless a most stringent Scab Act is put into forcible operation at an enormous expense and an army of Stock Inspectors engaged to see that it is complied with, and offenders are very heavily penalised, there is only one other way in which we can get rid of the disease, and that is, by getting every farmer in the country to work with and not against the authorities in complying with the existing regulations; and it is, therefore, the duty of every up-to-date farmer to prove to his less enlightened neighbours that scab is curable, and that the keeping of a clean flock is more profitable than the keeping of an infected one, and all should remember, in dealing with this disease, that it is quite as important to cleanse the place in which infected animals have been kept as it is to treat the animals themselves.

A good deal has been said lately about the possibility of framing a uniform scab law for the whole of South Africa, and although the problem is one which presents certain difficulties, these are by no means insurmountable if those who undertake the task keep before them the fact that the type of scab met with amongst goats and native sheep is not the same as that which affects woolled sheep so seriously, and that it is not absolutely essential for the stamping out of scab amongst the latter that an elaborate and expensive system of inspection and dipping of goats and native sheep be undertaken in the thinly populated and often unhealthy districts occupied by natives and in which no woolled sheep are kept.

SWINE FEVER AND SWINE ERYSIPELAS

are not diseases which have attracted much public attention, and, for that reason, no special regulations have been drawn up for dealing with these diseases except under the Transvaal Animal Diseases Ordinance, although the Government of Cape Colony have framed regulations for the landing of pigs in Cape Colony from any place beyond the Colony, save the Colony of Natal, for the purpose of excluding swine fever.

So far as can be ascertained there is no authentic record of any outbreak of swine erysipelas having occurred in South Africa, but swine fever infection has, unfortunately, become well established in various parts of South Africa, and it has received so little attention from stockowners that there is good reason for fearing that the

disease is much more prevalent than it is supposed to be, a circumstance which is likely to affect very materially any attempt to develop the pig-raising industry, which is somewhat unfortunate in a country where pigs thrive uncommonly well.

Swine erysipelas, which is said to be caused by a special bacillus, is characterised by elevation of temperature, marked depression, rapid breathing and patchy discolouration of the skin—symptoms somewhat similar to those shown in cases of swine fever, which was also attributed to the action of a bacillus until quite recently, when it was discovered that the disease could be reproduced experimentally by inoculating susceptible animals with blood taken from a diseased animal after passing it through a filter, the pores of which are fine enough to arrest any organism visible under the highest power of the microscope, a circumstance which indicates that the so-called bacillus of swine fever cannot be responsible for causing the disease, which must be due, like horse sickness, to an ultra visible organism.

In swine fever the symptoms resemble those of swine erysipelas, but, in addition to those detailed in referring to the latter disease, infected animals in typical cases suffer first from constipation and afterwards from diarrhœa; and, on *post mortem*, we generally find a certain amount of ulceration of the digestive tract, most common near the junction of the large and small bowel. These ulcers, which are frequently about the size of a threepenny piece, present a very characteristic appearance, being somewhat raised above the surface of the bowel with a yellow or blackish centre, and if pigs are found dying in any number in any locality and ulcers of this type are present in the bowels, it may safely be inferred that the animals are suffering from swine fever. In several instances, lately, in which outbreaks have come to the notice of the Veterinary Division in this Colony, the source of infection has been traced to pigs purchased at public sales; from which it would appear that when pigs are believed to be suffering from contagious disease, it is a common practice for owners to abstain from reporting outbreaks and to sell off the survivors. For this reason, any farmer who is thinking of going in for pig breeding on a large scale should be most particular as to the source from which he obtains his animals, and should abstain from purchasing animals haphazard at sales, otherwise the risk of introducing infection amongst his stock and sustaining a heavy loss is very considerable.

The Transvaal stock regulations provide for the isolation of in-contact animals, the destruction of infected pigs and the disinfection of the premises in which they have been kept, quarantine being maintained for at least thirty days after the death or slaughter of the last infected animal, and until the premises have been disinfected in a satisfactory manner; and, as experiments appear to indicate that the germ of swine fever retains its vitality for a considerable period in infected premises, the farmer who has been unfortunate enough to introduce the disease into his holding will be wise to refrain from attempting to restock for at least twelve months.

Mange in Horses and Mules.

During the progress of military operations, mange of both the sarcoptic and psoroptic varieties became extremely prevalent amongst equines in South Africa, but since the establishment of peace the disease has disappeared in a great measure and is no longer difficult to deal with. Of the two types of mange, sarcoptic mange, which generally makes its appearance about the withers and extends thence over the whole body, is most refractory to treatment on account of the burrowing habits of the parasite by which it is caused, while the psoroptic variety, which generally starts in the mane and tail, is more amenable to treatment. In animals kept under bad hygienic conditions, if no treatment is undertaken, the continuous irritation set up by the parasite and the changes which it produces in the skin, produce a condition of debility which frequently leads to death from exhaustion, and, in very advanced cases, the slaughter of the affected animal is often more economical than its treatment.

The general provisions of the various Animals Diseases Ordinances apply to mange in horses, but only in the Transvaal regulations are there special directions given for dealing with cases of mange. These direct the isolation of infected animals and the disinfection of the premises and harness. This latter point should not be lost sight of when an animal is under treatment for mange, as it is useless treating the animal and leaving the saddlery and harness infected. Another important point worth mentioning is the necessity which exists for not treating too large a surface of an infected animal's body with any oily antiparasitic dressing at one time. Not more than half of the body should be covered with such an application, as the interference with the functions of the skin may lead to serious results. A useful dressing for the treatment of mange is made by adding one part of creasote or oil of tar to about thirty parts of oil or lard. Dipping equines in an arsenical dip of the ordinary strength used for destroying ticks on cattle has a very beneficial effect in advanced cases.

Epizootic Lymphangitis.

This disease, to which horses, mules and donkeys are subject, and which cattle in exceptional cases are said to contract, is due to infection with a peculiar organism belonging to the family of yeasts, and is one which is very widely distributed, having been described as occurring in Italy, Russia, France, Algiers, Sweden, Japan and elsewhere. Reference is made to it in some of the earlier reports of the Chief Veterinary Surgeon of the Cape Colony, who found cases of it at Koonap Heights and in other parts of the Colony ; and in the Umtali District of Rhodesia the disease was the cause of considerable loss amongst equines in 1898. The specific organism does not seem to affect animals in which the skin is unbroken, but where any breach of surface exists, such as may arise from the friction of harness or the bites of ticks, the organism may establish itself, probably through the agency of ticks, flies or contaminated harness, and produces a condition

closely resembling that seen in farcy, with which it is frequently confounded. The infected wound assumes an unhealthy appearance, does not tend to heal, the surrounding lymphatics become inflamed, small nodules form along their course which ultimately suppurate and are followed by the development of unhealthy sores arranged in linear fashion and most commonly seen on the inner surface of the limbs along the side of the abdomen, neck or face. The neighbouring lymphatic glands become swollen and indurated, and are not infrequently the seat of abscesses, and occasionally abscesses develop in the internal organs with fatal results. The disease is most refractory to treatment and frequently months elapse before infected animals recover, even if carefully looked after. The actual mortality caused directly by the disease is not as a rule high, but its contagious nature and the long period for which animals have to be thrown off work render the disease a most important one from an economic point of view, while the similarity existing between this disease and farcy occasionally leads people to undertake the treatment of cases of farcy, mistaking such cases for epizootic lymphangitis—an exceedingly dangerous and unprofitable proceeding, as farcy may be readily communicated to human beings with fatal results. Animals do not tend to recover spontaneously from this disease without surgical interference, and advanced cases of the disease assume such characters that their successful treatment is practically impossible. For this reason the Transvaal regulations give a Government Veterinary Surgeon power to order the destruction of infected animals when he considers this course necessary, and direct owners to carry out treatment according to the directions of the Government Veterinary Surgeon if treatment appears possible.

On account of the contagious character of the disease, the disinfection of premises, utensils and harness after an animal has been destroyed or has recovered from this disease must be very thorough, and the authorities should always be promptly notified of the occurrence of suspicious cases, as in the early treatment of cases of epizootic lymphangitis lies the greatest hope of a successful issue.

Sheep Pox

is a disease hitherto unknown in South Africa, but is one which might very readily be introduced, and is a disease amongst many others which will be referred to in the continuation of this article, for which the Government Veterinary staff must be constantly on the look out as the mortality which attends an epidemic of sheep pox ranges from 15 to 50 per cent. The disease which may be brought to this continent by the importation of infected or recently recovered sheep from France or some other European country, is ushered in by a period of great depression and elevation of temperature. There is marked congestion of the mucous membranes of the eyes and nose and an increased discharge from these organs. An eruption then makes its appearance chiefly on those portions of the body on which

the wool is thinnest or absent; on the face, insides of the limbs, abdomen, scrotum and udder. Beginning as an outcrop of red pimples, these develop into vesicles in which a colourless or orange-yellow fluid accumulates. Later, the vesicles become purulent, scabs form, there may be a cough, with difficulty in swallowing and breathing, diarrhœa may supervene, and the animal may die after a course of illness which may last up to three weeks. Importers of sheep from Europe should always be on the look out for this disease, and the attention of the Veterinary Division should be immediately called to the appearance of cases of illness amongst sheep presenting the characters described.

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SWINE FEVER.

The following notes on the *ante* and *post-mortem* symptoms of swine fever are published with the object of calling attention to the recent outbreaks of the disease in this Colony. Farmers are earnestly requested to report the occurrence of any deaths amongst swine from unknown causes in order that the Department may have an opportunity of enquiring into the cause of the mortality. The following description of the disease is given for the information of the public :—

Symptoms.

This contagious eruptive disease is caused by a microbe—the bacillus of swine fever. The disease may come on rapidly, especially in young pigs. This is the acute form, which generally ends fatally in about three days. The symptoms are less definite than in chronic cases. The temperature is high—105° Fahr., or even higher; the breathing is quick; the pigs seem to have lost control over their hindquarters, and stagger if made to walk. A red rash appears on the skin at the base of the tail, under the belly, inside the thighs, and on the ears.

Usually the symptoms come on more slowly. The pigs appear to be dull; they lie under cover and are disinclined to move. The appetite is lost; frequently the animals vomit. Constipation, followed by diarrhœa with blood-stained fæces, is often observed. A mucous discharge may be present around the eyes. Red patches, which later on assume a violet tinge, are observed at the base of the tail, inside the thighs and hocks, under the belly, and on the ears. The temperature is high—104° to 106° Fahr.

The pigs can be roused only with difficulty, and when made to move they stagger about as if inebriated. Very frequently lung symptoms are present. In this case the sick animals suffer from a short cough, and the breathing is very laboured. The animals die in from one week to three. They may, however, drag on for two months or more in an emaciated condition.

Post-Mortem.

The carcase is generally emaciated. The discoloured patches on the skin have a livid hue, but this is also seen in other diseases of swine.

In acute cases followed by rapid death, the changes are not characteristic, but one's suspicions should be aroused if a number of swine become sick about the same time. In the more chronic cases the most characteristic change—ulceration—is found in the alimentary tract. The ulcers may be present on the tongue, the stomach, or any part of the bowel, but in most cases they are confined to the more posterior portions of the latter, particularly around the junction of the ileum with the caecum.

The most typical ulcer is about the size of a three-penny piece. Its edges are circular, and raised above the membrane. The centre of the ulcer is soft, and often yellow or black in colour. The other parts of the bowel may be inflamed, and often the inner surface is covered by a yellowish deposit. Two loops of bowels may have grown together.

The lungs are very often, though not always, solid in patches, and fluid may be present in the chest. The glands are very red in colour in the more acute cases.

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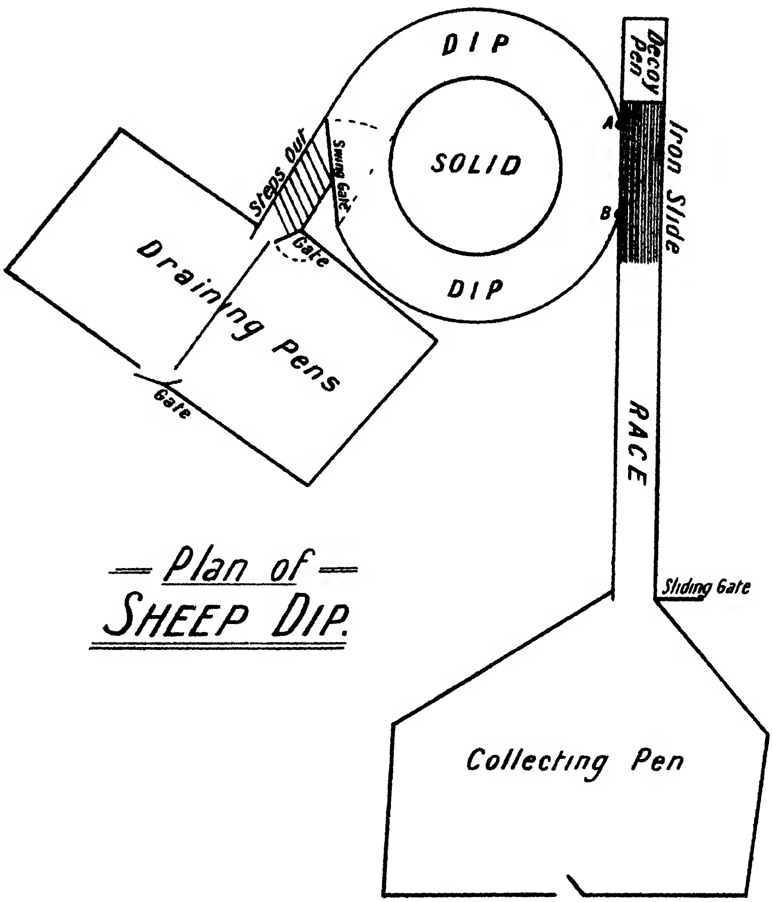
AN IMPROVED SHEEP DIPPING BATH.

By Thomas H. Dale, M.R.C.V.S., G.V.S., Potchefstroom.

Thanks to the courtesy of Captain Bennett, District Commandant, Potchefstroom, and Captain Place, District Commandant, Wolmaransstad, the police in this district have compiled a list of the sheep dipping baths recently erected in their respective patrol areas. This list contains the owner's name, farm with number, approximate number of sheep and goats dipped, and the charge made to owners of sheep for the use of the bath. It is thus very complete, and, thinking that the farmers of the Transvaal would be interested to know what their brethren of the West are doing in the fight against scab, a short summary of these reports is here given with a rough sketch of an improved dip. The number of dips built in the Potchefstroom* district is 31, situated on 30 farms fairly evenly distributed throughout the district. In one instance five owners on the same farm joined together and shared the expense, whilst in several cases two farmers combined for the same reason. The total number of sheep and goats dipped is 57,447, or an average of 1,853 for each dipping bath.

In the Wolmaransstad district 53 new dipping baths have been built on 50 farms, and they are so evenly distributed throughout the

* I had overlooked the fact until too late for these notes that the return for the whole of the Potchefstroom District is not complete, as that portion of it situated east of a line drawn due north and south from the farm Orange Grove 162 to Lindeque Drift, on the Vaal River, is patrolled by the Heidelberg police.



Plan of SHEEP DIP.

Plate CXXXIII.

country that very few farmers of sheep are able to plead that there is no dip within easy distance. The total number of animals dipped in this area is 144,866, or an average for the 84 baths of 1,724.

These baths are all of a permanent character, but vary very much in design and the material used. In some cases the owner has followed approved lines; in others he has diverged from them for various reasons. In some it has been a question of "pocket"; in others again the character of the building material nearest to hand has had a help in determining the shape and size of the prospective dip. Some are very elaborate and expensive, others again little more than an oblong cement tank sunk into the ground and big enough to dip one animal at a time; but of whatever type they are, they are all a long way in advance of the ox hide slung from a tree or the bully beef tin and the bit of rag which was in vogue when I took over these districts three years ago. Plate CXXXIII. shows a rough sketch of a dipping tank supplied by Stock Inspector Danvers, who is stationed at Wolmaransstad, which possesses many peculiar advantages of its own. I think that I am right in saying that no one dip has all the advantages of the one illustrated, but many possess some of them and they have been found to work well. A short description will, perhaps, help to explain the sketch. A collecting pen is provided with a race to the dip which differs from those most commonly seen, in that the bath is not at the end of it but at the side, the reason for this being that the sheep cannot see the dip from the collecting pen and thus come out of the collecting pen boldly to join three or four of their fellows in the decoy pen at the other end of the race. They never get there, however, as opposite the bath there is an opening in the race wall and the floor at this point consists of an iron slide set at such an angle that the sheep cannot obtain a foothold but slide down it through the curtain into the bath. This curtain consists of a piece of old sacking nailed across a rail from A to B, which prevents the sheep from seeing the liquid in the bath, and as it slides down, the curtain is pushed aside and the sheep falls into the dip. The advantage of the decoy pen and the iron slide is that it does away with all handling of sheep, and is, therefore, a great saving of labour. The bath itself is circular, but differs from most circular baths I have seen in use, and also those described by most manufacturers of patent dips, in that it has an island in the centre. The advantages of the arrangement are many. Firstly, as the passage is not straight the sheep cannot see the exit race, and, therefore, does not make a wild rush to get out. Secondly, one man on the island can control the whole outfit. Instead of having two or three men round the dip, one in the centre can submerge an animal at any point and can also control the swing gate at the exit. Thirdly, if it is considered that a sheep has not been sufficiently dipped by the time it reaches the exit, the gate is swung to and the animal sent round again, which saves catching it and throwing it in again as in the old way. Fourthly, as the centre is solid, very much less water is required to fill the bath, and, consequently, very much less dip is used and

money is saved. The exit race does not differ materially from those usually illustrated except that it is at an angle, and therefore enables the sheep to get out with less effort. The draining pens are of the usual type.

The main features and advantages of this bath are :—It is easily worked ; the animals are easily controlled ; there is a big saving of labour ; a great saving in the quantity of the dip used ; and last, but not of least importance, efficient dipping is obtained. It is certainly not the quickest dip in use. Anyone building one must not expect to break records, but the man who boasts that he can run so many thousands through in a day fails to accomplish the work for which the dipping is intended, and sheep hurriedly dipped are always badly dipped, and, as a consequence, have probably to be done over again, and loss of time and material is involved. It will be seen that no attempt has been made to give dimensions or cost of construction, as the former varies in almost every case according to the fancy of the builder, while the latter depends largely on the situation of the farm and the facilities for obtaining the necessary material on it or in its vicinity. I may add, however, that most are built with rough stone obtained on the farm and faced with cement.

* * * *

RETURN SHOWING NUMBER OF FARMS FRESHLY INFECTED WITH EAST COAST FEVER FROM JULY 1ST, 1905, TO 30TH JUNE, 1906.

District.	No. of Fresh Outbreaks	No. of Deaths in Fresh Outbreak	In-contacts Examined
Middelburg	10	34	937
Lydenburg	5	59	108
Barberton	7	222	894
Marico	1	2	181
Zoutpansberg	42	190	1,954
Rustenburg	9	85	1,015
Pretoria	1	28	349
Piet Retief	11	105	1,173
Ermelo	8	67	559
Waterberg	4	8	129
Totals	98	800	7,299

During the year ending June 30th, 1905, 214 outbreaks of East Coast Fever were dealt with, 7,957 head of cattle died, whilst there were

24,737 in-contacts. There is, therefore, a considerable all round decrease in this year's statistics, and during the year no fewer than 128 farms and erven, formerly gazetted as infected, have been taken out of quarantine.

RETURN OF MULES IMMUNISED UP TILL END OF JUNE, 1906.

District	Inoculated	Discharged	Deaths.	Remaining.
Barberton	187	184	3	*Nil*
Krugersdorp	35	34	1	*Nil*
Lydenburg	106	102	4	*Nil*
Middelburg	71	69	2	*Nil*
Piet Retief	84	79	5	*Nil*
Potchefstroom ..	159	150	5	4
Pretoria	646	597	29	20
Rustenburg	493	472	20	1
Waterberg	174	164	10	*Nil*
Zeerust	48	47	1	*Nil*
Zoutpansberg	316	309	7	*Nil*
Swaziland .. .. / Mbabane	39	38	1	*Nil*
Heidelberg	6	6	*Nil*	*Nil*
Totals	2,364	2,251	88	25

Percentage of Deaths, 3·7.

COMPARATIVE RETURN.

Number of Outbreaks, etc.	1904–5	1905–6
Glanders—		
Number of outbreaks	107	135
Died or destroyed	132	173
In-contacts malleined	525	1,015
Ulcerative Lymphangitis—		
Number of outbreaks	114	67
Died or destroyed	81	17
Sick animals put under treatment ..	187	75
In-contacts examined	403	146
Lung Sickness—		
Number of outbreaks	13	8
Died or destroyed	71	12
Cattle inoculated	3,109	431

COMPARATIVE RETURN.—(*Continued.*)

Number of Outbreaks, etc.	1904-5	1905-6
Scab—		
Number of outbreaks	367	370
Died or destroyed	178	12
Affected animals put under treatment	62,482	57,804
In-contacts examined	45,174	78,232
Tuberculosis—		
Number of outbreaks	8	6
Died or destroyed	8	6
In-contacts tested with tuberculin ..	211	297
Swine Fever—		
Number of outbreaks	3	6
Died or destroyed	138	1,038
Anthrax—		
Number of outbreaks	11	10
Died or destroyed	28	15
In-contacts dealt with	156	466
Mange—		
Number of outbreaks	59	26
Died or destroyed	5	1
Sick animals put under treatment ..	263	56
In-contacts dealt with	56	39

In all 726 outbreaks of contagious disease in stock have been attended to, 2,074 animals have died or been destroyed as incurable, 57,935 have been put under treatment, and 80,626 have been examined as "in-contacts."

Besides the outbreaks just referred to a large number of reported cases of contagious diseases have been investigated and diagnosed as non-contagious.

No outbreaks of the following diseases have been reported —Rinderpest, Foot and Mouth Disease, Swine Erysipelas, Sheep Pox, Rabies.

NON-PROCLAIMED PORTS OF ENTRY STATISTICS FOR THE YEAR 1ST JULY, 1905, TO JUNE 30TH, 1906

Class	Number presented at Port.	For Slaughter	For Stocking	Transport To and Fro.	Number Passed	Number Rejected
Horses	1,505	—	145	1,360	1,505	—
Mules	799	—	7	792	799	—
Donkeys	1,020	—	513	507	1,020	—
Cattle	2,572	27	2,545	—	2,572	—
Sheep	61,230	1,260	59,376	—	60,636	594
Goats	10,594	330	9,294	—	9,624	970
Swine	95	90	5	—	95	—
TOTAL	77,815	1,707	71,885	2,659	76,251	1,564

PROCLAIMED PORTS OF ENTRY STATISTICS FOR THE YEAR 1st JULY, 1905, TO JUNE 30th, 1906.

Class.	Number presented at Port.	For Slaughter.	For Stocking.	Transport To and Fro.	Number Passed.	Number Rejected.
Horses	12,703	—	8,316	4,380	12,696	7
Mules	5,102	—	2,952	2,150	5,102	—
Donkeys	7,506	—	3,992	3,514	7,506	—
Cattle	36,323	18,607	17,056	576	36,239	84
Sheep	439,042	165,742	266,387	—	432,129	6,913
Goats	69,027	3,734	63,254	—	66,988	2,939
Swine	14,501	13,704	792	—	14,946	5
Total	585,104	201,787	362,749	10,620	575,156	9,948
Non-proclaimed P'rts	77,815	1,707	71,885	2,659	76,251	1,564
GRAND TOTAL	662,919	203,494	434,634	13,279	651,407	11,512

Return Showing Number of Farms Freshly Infected with Rhodesian Redwater during the Month of July, 1906.

District	No. of Farms Freshly infected	No. of Cattle Thereon	No. of Deaths During Month.
Rustenburg	nil	nil	nil
Pretoria	nil	nil	nil
Waterberg ...	nil	nil	nil
Barberton	nil	nil	nil
Zoutpansberg	4	53	12
Marico	nil	nil	nil
Ermelo	nil	nil	nil
Lydenburg ..	nil	nil	nil
Piet Retief	nil	nil	nil
Middelburg	1	136	1
Totals	5	189	13

Return of Mules Immunised for other Departments and Public Bodies during the Month of July, 1906.

District	Department or Public Body	No. of Mules
Pretoria ...	Municipality	20
Swaziland	South African Constabulary	6

Return of Mules Immunised during the Month of July, 1906.

District.		On Hand.	Inoculated.	Discharged.	Deaths.	Remaining.
Barberton ...	...	nil	9	nil	nil	9
Krugersdorp	...	nil	nil	nil	nil	nil
Lydenburg	...	nil	nil	nil	nil	nil
Middelburg	...	nil	nil	nil	nil	nil
Piet Retief	...	nil	nil	nil	nil	nil
Potchefstroom	...	4	3	7	nil	nil
Pretoria ...	...	20	20	19	1	20
Rustenburg	...	1	nil	nil	1	nil
Waterberg	...	nil	nil	nil	nil	nil
Zeerust ...	...	nil	nil	nil	nil	nil
Zoutpansberg	...	nil	nil	nil	nil	nil
Swaziland...	...	nil	19	nil	2	17
Heidelberg	...	nil	nil	nil	nil	nil
Ermelo ...	...	nil	44	nil	8	36
Totals	...	25	95	26	12	82

Complete Statistics of Inoculation up to 31st July, 1906.

Inoculated.	Discharged	Deaths	Remaining
2,459	2,277	100	82

Percentage of Deaths, 4·3.

THE CHEMICAL SECTION.

THE USE OF LOCUSTS AS FOOD.

By Herbert Ingle, B.Sc., F.I.C., F.C.S.
(Chief of the Division of Chemistry).

The scourge of locusts from which the Colony has suffered during the past winter has attracted public attention, and several proposals have been made for the utilisation of the insects for feeding purposes. Some of these references have been made in public,* others in various Journals,† while this Division has received several inquiries as to the value of locusts as food for poultry and pigs.

It is well known that the Kafirs in many districts find the locusts very acceptable as a food, and that they eagerly catch and eat them. But, despite the precedent established by John the Baptist,‡ whose diet affords one of the earliest examples of a "well-balanced ration," and the permission of the Mosaic Law,§ it is not probable that the prejudice which most white people hold against the use of insects as food will be readily overcome. It is hardly to be expected then that locusts will become a favourite diet among Europeans for some time to come. But when the insects are so abundant as they have been lately, it is certainly desirable that they should be utilised if possible, especially as, in this way, some profit might be reaped from what is, undoubtedly, an evil,** while the future benefit which would accrue from the destruction of the locusts would materially aid the endeavours of the Government to rid the Colony of the pest. Though the diminution in numbers of the locusts, consequent upon the general adoption by farmers of collecting them for feeding purposes, would be absolutely very considerable, yet, relatively to the whole, it would be perhaps, almost inappreciable, and, as a means of destruction, the practice would be wholly inadequate. Still, on the principle that "every little helps," the assistance afforded to the efforts of the Division of Entomology by the general adoption of such a practice is not to be despised.

But apart altogether from this indirect benefit, I hope to show that the direct profit accruing from the plan would be quite sufficient to justify its general adoption. The composition of the

* e.g. by Mr E. F Bourke, M L C, in the Legislative Council (July, 1906).

† See *Farmers' Advocate*, March, 1906 *Cape Agricultural Journal*, June, 1906, p 751, also August, 1906, p. 158.

‡ "And he did eat locusts and wild honey."—Gospel of St. Mark i, 6.

§ "Even these of them ye may eat, the locust after his kind and the bald locust after his kind, and the beetle after his kind, and the grasshopper after his kind."—Leviticus xi., 22.

** The damage done by locusts during the past autumn and winter in the Transvaal is estimated by Mr. C. B. Simpson, the Government Entomologist, as amounting to more than £50,000. (See *T.A.J.*, July, 1906, p. 852)

powder resulting from grinding in a mill the sun-dried adult locusts which had been killed by half-an-hour's immersion in boiling water is shown in the following table. The samples were sent to the laboratories by our Poultry Expert, Mr. R. Bourlay, who informs me that the insects were caught, boiled and dried by Mr. Alf. Yorke, of Christiana. The insects were of the brown variety (*Pachytylus sulcicollis*). The results of the analyses of two samples were as follows :—

		1		2
Moisture		9.05		11.62
Ash		5.12		5.56
Containing Silica	1.31%		1.75	
Lime	0.28%		0.27	
Potash	0.52%		0.52	
Phosphoric Acid	1.59%		1.36	
Ether extract (fat, etc.)		11.19		10.91
"Crude Fibre"		11.26		—
Protein (nitrogenous matter)		59.60		56.32

There was also a small quantity of some sugar-like compound, the amount and nature of which has not been determined. It is quite possible that this carbohydrate was derived from the food in the stomachs of the insects. The high value for protein—59.6%—and fat—11.19%—show how rich in the most expensive items of animal food the ground locusts are.

As explained in the last number of this Journal (p. 818), the approximate market value of a food may be calculated by assessing the protein and fat at 5/- "per unit," and the carbohydrates at 2/- "per unit." Ignoring the last, the value of the locust meal would thus be (59.60 + 11.19) × 5/-

70.79 × 5/- = 353.95 shillings

= £17 13s. 11d. per ton ;

but, as some of the nutrients are probably indigestible, say, £15 per short ton, or 15/- per 100 lbs.

Of themselves, locusts are too rich in protein to form suitable food and require the addition of carbohydrates (starch and sugar). Hence the appropriateness of a diet of "locusts and wild honey"—the latter food consisting almost entirely of carbohydrates. The "albuminoid ratio" of locusts is, doubtless, very "narrow." To calculate it, "digestible" constituents ought to be considered, but of these we have no data. It is only fair to say that, in all probability, a considerable proportion of the protein may be present in the form of "chitin," a hard, horny substance forming the outer covering of insects, and difficult of digestion for most animals. The "digestion co-efficient"* for the protein in locusts is, therefore, probably low

* For explanation of this term see *T.A.J.*, p. 815. I have been furnished with a sample of the excrement of chickens fed partly on locusts by Mr. Bourlay, and very little indication of undigested fragments of the insects can be detected in it, though under the microscope such undigested matter is visible.

with many animals. Assuming it to be 75, and that of the fat 100, the albuminoid ratio would be $\frac{75}{100} \times 59.6 \div 11.19 \times 2.3 = \frac{44.7}{25.74}$
$= 1 : 0.576$

It is thus evident that, in order to make a ration of the proper albuminoid ratio (about 1 : 4), locusts should be mixed with a considerable quantity of foods rich in starch or other carbohydrate.

Now, in this country, the commonest error in feeding is the use of rations with too wide an albuminoid ratio. For example, mealies are largely used as food, and they, of themselves, are far too rich in non-nitrogenous matter to furnish a properly-balanced ration as they usually have an albuminoid ratio of about 1 : 9.7 This is far too wide for many purposes, and there can be no doubt that much injury is done to many animals by the continued use as food of mealies only. This is pre-eminently the case with poultry, the ration for which should have a much narrower ratio. By adding ground locusts to the mealie meal, the ratio could be narrowed to almost any extent, and a ration framed to suit almost any requirements. Thus, suppose it is desired to prepare a mixture which shall have an albuminoid ratio of 1 : 5, and we wish to know how much of the ground locusts we should mix with, say, 10 lbs. of mealie meal*—

Let x = the amount of locust meal in lb.

then
$$\frac{x \times 0.447 + 10 \times 0.079}{x \times (.112 \times 2.3) + 10\,(0.667 + 0.043 \times 2.3)} = \frac{1}{5}$$

$$2.235\,x + 3.95 = 0.257\,x + 7.66$$
$$1.978\,x = 3.71$$
$$x = \frac{3.71}{1.978} = 1.88 \text{ lb. nearly.}$$

Thus a mixture of 1 lb. of ground locusts with about 5 lbs. of mealie meal would furnish a well-balanced and almost ideal food for poultry.

There is also another advantage accruing from the employment of locusts—the making up of the deficiency in ash constituents, especially phosphates, which characterises mealies.

Mealies usually contain about 1.5% of ash, of which about 0.70% is phosphoric acid. Locusts contain, as shown in the analysis quoted, over 5% of ash including about 1.6% of phosphoric acid, and a considerable quantity of potash. They would thus compensate for the deficiency in mineral matter, which, according to the opinion of many people (and for which there is considerable evidence), is one

* Assuming the *digestible* constituents to be as follows —

	Locusts.	Mealie Meal.
Protein	44 7 per cent	7 9 per cent.
Fat	11·2 per cent.	4 3 per cent
Carbohydrates ...	nil	66 7 per cent.

of the main causes of the susceptibility to disease among animals fed upon many of our African-grown foods.

SIMILARITY IN COMPOSITION OF DRIED LOCUSTS TO COMMERCIAL FOODS.

In the laboratories of the New York Agricultural Experiment Station, inspection and analyses of many commercial foods are made. In Bulletin No. 268 (September, 1905) of the Station, the amounts of protein and fat in a large number of these foods are quoted. Among many others, the following, which resemble locusts in composition, are given :—

	Protein.	Fat.
Armour Fertiliser Works, Chicago.—		
Meat and bone for poultry	53.20	12.20
Meat Meal	58.80	13.30
The Berg Co., Philadelphia.—		
Three Medal Poultry Meat	53.0	12.5
Bowker Fertiliser Co., Boston.—		
Beef scraps	56.10	16.60
Darling & Co., Chicago.-		
Beef meat for poultry	51.0	9.0
Beef scraps	57.10	13.10
Geo. L. Harding, Binghampton.—		
Celebrated Meat Meal	40.19	13.70
High Grade Beef Scraps	43.50	26.20
Spratt's Patent, Ltd., Newark.—		
Ground meat	59.20	15.50
Swift & Co., Chicago.—		
Beef scraps	65.80	7.30
Swift's Lowell Fertiliser Co., Boston.—		
Beef scraps	47.90	13.90
Wuychet Fertiliser Co., Dayton.—		
Ground beef scraps for poultry	58.10	11

The prices of the above foods range from 40 to 60 dollars (£8 to £12) per ton. The average for the above twelve commercial foods gives 53.67 per cent. of protein, and 13.70 per cent. of fat, as compared with 59.6 of protein and 11.19 per cent of fat in the dried locusts.* There can be little doubt, therefore, that locusts are fitted, from their chemical composition, to form a valuable constituent in the food of poultry. At the same time, they should be used with care, since they are highly nitrogenous, and, given alone, would probably be too stimulating. The advisability of using them in conjunction with starchy foods, *e.g.*, mealies or Kafir corn, has already been insisted upon. For pigs, too, they would, undoubtedly, prove

* No doubt the composition of locusts will vary considerably, according to whether they are full or empty of eggs. Those full of eggs will undoubtedly contain a higher proportion of nutrients and be more digestible than those which have already laid their eggs.

excellent, and I see no reason why they should not also be fed to cattle and sheep. If dairy cows would eat them, and of this I have little doubt, if mixed with other food, they would prove very valuable for milk production ; while the manure produced by the animals would be greatly enriched in fertilising constituents.

As Manure.

In fact, locusts are well worth collecting and killing for manurial purposes. Their value as a fertiliser is very great because of their richness in nitrogen and phosphoric acid. Compared with the prices of artificial manures at the coast, they are worth about £7 10s. per ton, though it is only fair to say that their nitrogen is probably not very readily available and that they, therefore, are somewhat slow in action. If they were finely ground, and, better still. if the fat were removed, their decomposition in the soil would, doubtless, be more rapid. In the Argentine, in 1899, they were found to give excellent results when mixed with superphosphate.

Method of Collecting and Preparing the Locusts.

On this subject I cannot advise from personal knowledge, but I am told that, in the case of large swarms of the winged insects, there is little difficulty in collecting them at night or in the early morning on their roosting grounds. Natives can readily scoop them into sacks from the ground or bushes on which they collect in thick clusters. It is then best to kill them by immersing the sacks and their contents in a large pan of boiling water for 20 minutes or half-an-hour. After this, they should be spread out on a clear surface to dry in the sun. When thoroughly dry, they can be bagged and will keep unchanged for a long time. They may be fed whole, or, better probably, after passing through a mill.

Voetgangers.

In this state, the insects are probably more digestible, and, weight for weight, more valuable for feeding purposes than in the flying state, while they are certainly more readily collected. When the screen method of destruction, as employed by the Division of Entomology, is used, the insects could readily be obtained in enormous quantities ; even when the voetgangers are killed by arsenical poisoning they might probably be safely used for poultry food if given in small quantities only.

Practical Effects of Feeding Locusts to Animals.

On this point I am not aware of any careful or complete tests, but Mr. Bourlay has been feeding young chickens for some weeks on a diet consisting of ground locusts and wheat meal, so far with great success, the birds appearing to thrive remarkably well.† I am

† With Mr. Bourlay's assistance, it is hoped to conduct some careful feeding trials on poultry in order to test practically the value of the locust meal as a food.

told also that the natives are well aware of the fattening effect of a locust diet upon pigs. Mr. P. Maynard, of the Pyramids, near Pretoria, has been successfully using both boiled and roasted locusts as a pig food. The roasted locusts were collected after a bush fire which occurred while the locusts were using the bush as a roosting place.

In conclusion, I would earnestly recommend the proposals contained in this short article to the notice of farmers, poultry-keepers and all who have the opportunity of collecting locusts, feeling assured that the subject is one which merits attention, and that, by the adoption of such methods, what is undoubtedly one of the greatest evils under which agriculture in this country suffers, might be made to yield some slight compensation in profit to those who will take a little trouble. It is quite possible that enterprising dealers may find it practicable to create a trade in dried locust meal for feeding purposes, and there can be little doubt that if the value of the product, as a poultry food particularly, could be demonstrated in practice, even an export trade might reasonably be anticipated. The supply of the raw material is uncertain and variable, and it is to be hoped that it will not again equal that of the last winter, but it is true wisdom to be prepared to make the most profitable use, even of misfortune.

NOTE.—Since the above was written, an article in the "Cape Agricultural Journal" for March, 1905, p. 406, by C. W. Mally, M.Sc., Acting Government Entomologist, Grahamstown, has come to my notice. In this article the author emphasises the value of locusts as a stock food, and describes in detail a method of trapping voetgangers and collecting them in bags with a view to their being dried and used as food for horses, sheep, pigs and poultry. He alludes to an opinion held by many farmers that a diet of locusts to laying hens produces a larger and redder coloured yolk in their eggs, but expresses doubt as to any influence upon the flavour of the eggs. But the effect of immoderate eating of the insects upon poultry is probably very different from that produced when the hens are fed with a properly-balanced ration of locusts and starchy foods, and it has not been shown that, under such conditions, any objectionable effect is produced.

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II. THE INTERPRETATION OF CHEMICAL ANALYSES FOR FARMERS.

By HERBERT INGLE, B.Sc., F.I.C.

PART III.

CLASS IV.—ANTISEPTICS AND MISCELLANEOUS.

In this third and concluding part of the paper, reference will be made to the most important substances used on the farm in the destruction of injurious or objectionable insects, animals, micro-organisms, plants or

products of decay. It will be convenient to classify these under the following heads:—

I. Insecticides.
II. Animal Poisons.
III. Fungicides.
IV. Plant Poisons.
V. Antiseptics and Disinfectants.

I.—Insecticides.

By this term is understood a substance which can be used to kill insects or creatures similar to insects. The destruction may be produced in three ways:—

A.—By poisoning the food eaten by the insects or by absorption through their skin.

B.—By poisoning the air breathed by the insects.

C.—By suffocating the insects by stoppage of their breathing apparatus.

Under Class A. large numbers of chemical compounds may be included, in fact nearly all which are poisonous to the higher animals (Class II.) are fatal to insects. Among those most largely used for the purpose of destroying objectionable insects are the following.—

Arsenic.—This substance is never used in pure elementary state, but in the form of its oxide—arsenious oxide, As_2O_3, or some compound containing this. Indeed in common language "arsenic" or "white arsenic" is generally used to designate what the chemist would call arsenious oxide.

This is a heavy, white substance not readily soluble in water, but dissolving easily in alkalies, *e.g.*, caustic soda, or even sodium carbonate solutions. The solution really occurs because the arsenious oxide is converted by the soda into sodium arsenite or arsenite of soda. Arsenious oxide is used as a vermin poison, and is fatal to most forms of animal and plant life. Certain low forms of vegetables, however, can develop in presence of considerable quantities of arsenic. This is the case with many moulds. But to higher plants arsenical solutions are quickly fatal, even when highly diluted.

In very small doses, arsenic acts as a tonic upon animals and confers by continued use, an immunity to doses which under ordinary conditions would be sufficient to cause death. The administration of arsenic in small doses often produces a plumpness and sleekness of the skin, but is attended with danger of setting up chronic poisoning.

As an insecticide, arsenical compounds are largely used, both for animal and plant parasites. Thus it enters into the composition of many dips for sheep, cattle, etc.

Arsenic in Dipping Compositions.—In these, the arsenic is usually present in the form of sodium arsenite in order to render it more soluble. Though in many commercial dips, other substances are also present, in the majority of the arsenical preparations, the efficiency depends upon the amount of arsenic present.

In this country particular interest attaches to the destruction of ticks on cattle and sheep, because of the transmission of disease by these insects. According to Mr. Lounsbury's experiments in Cape Colony,* it appears that to ensure the killing of all ticks, the solution must contain about 1 lb. of arsenious oxide in 30 gallons of water, *i.e.*, 0·33 per cent., though for practical purposes 1 lb. in 40 or 45 gallons (0·25 to 0·22 per cent.) he estimates to be sufficient. A preparation reported to be efficient in Queensland contains 1 lb. in 50 gallons, *i.e.*, 0·2 per cent. In the same paper Mr. Lounsbury concludes that the addition of tar, or soap, to the arsenical dips has little or no effect upon their poisonous qualities. He also gives a table from which can be deduced that two well-known arsenical dips—Demuth's and Alderson's—contain about 11 and 46 per cent. of arsenious oxide respectively, and that when diluted in accordance with the makers' directions, viz., 1 lb. to 6 gallons and 1 lb. to 14, they yield a liquid containing arsenious oxide in the proportions of 1 lb. to 65 gallons and 1 lb. to 30 gallons respectively. He also states that "scrub exterminator"—crude arsenite of soda—contains about 66 per cent. of arsenious oxide,† and diluted so as to contain about 1 lb. of arsenious oxide in 40 to 50 gallons of water, forms a thoroughly efficient destroyer of ticks. Dips of this strength can be safely sprayed on cattle, but if fat and long-woolled, sheep are liable to be injured when dipped by absorption of arsenic through the skin. Injury by once dipping in this strength is probably little, but if repeatedly dipped at weekly intervals, sheep exhibited symptoms of arsenical poisoning and in many cases died

Later, in the same Journal (May, 1906), p. 724, a dip containing—

Arsenite of soda	5 lbs.,
Aloes..	12 ounces,
Soft soap	5 lbs.,
Water	100 gallons,

is recommended. The aloes is merely added to render the dip distasteful so as to lessen the risk of the animals drinking it. This dip probably contains about 0 3 per cent. of arsenious oxide.

The soft soap is thought to increase the effect upon the ticks by keeping the dip moist for a longer time after dipping and for long-woolled sheep it is recommended that the soap be omitted.

In the same number of the Journal (p. 620) are given several resolutions of the Komgha Farmers' Association with respect to this dip, in which they consider the soap unnecessary, and that for milch cows the strength should be 4 lb. of arsenite of soda to 100 gallons of water (*i.e.*, about 0·24 per cent. arsenious oxide). If the animals are dipped with too strong an arsenical solution, or too frequently, poisoning through absorption of the arsenic through the skin may ensue. This is apparently most likely to occur with long haired or long woolled animals. Thus it occurs more readily with sheep than with cattle or horses. It is also said to be more likely to occur if the animals be dipped or sprayed while hot.

* *Cape Agricultural Journal*, March, 1905, p. 390

† My experience is that commercial arsenite of soda frequently contains about 56 per cent. of arsenious oxide.

It is unnecessary, perhaps, to emphasise the need of care in using so poisonous a substance as arsenic, but every precaution should be taken to prevent animals drinking the dip or licking or eating anything with which the arsenical preparation has been in contact.

Arsenic compounds are also largely used for the destruction of insects injurious to plants or vegetable products. Thus arsenious oxide is now strongly recommended for poisoning white ants. The most successful plan of using it for this purpose is to vapourise a mixture of sulphur and arsenious oxide in a suitable apparatus and force the vapours by means of a pump into the ants' nest. The vapour of arsenious oxide is itself intensely poisonous, while as it cools it impregnates the workings and their contents with a sublimate of itself, which would be fatal to any insect which might escape the effect of the fumes and afterwards eat any of the stores within the nest. An apparatus designed for performing this operation is described in the last number of this Journal (p. 844); the material supplied with the machine was examined in our Laboratories, and was found to consist of about 11 per cent. of sulphur and 89 per cent. of arsenious oxide, intimately mixed together. Arsenic, generally as sodium arsenite, is the basis of many preparations for the destruction of ants or preserving wood, etc., from their attacks.

Another important use of arsenic is for poisoning locusts. The plan adopted by the Division of Entomology is to spray the grass or other vegetation in the neighbourhood of a swarm of "voetgangers" with a solution containing—

Arsenite of soda	1 lb.
Sugar	1 lb.
Water	8 gallons.

The grass so sprayed, if consumed by locusts, soon poisons them, or if not, quickly dies and dries. If eaten by cattle or sheep soon after spraying, injury might result, but after a few showers of rain the arsenic is, to a great extent, washed off into the soil.

Even if no rain falls, the danger of cattle eating the poisoned grass is not great after a few days, as the grass dies and withers, and, except under stress of hunger, would be rejected. The poisoned insects are often eaten by poultry, locust birds, etc., and though they contain considerable quantities of arsenious oxide (in one sample we found 0.291 per cent. in the dried insects) they do not appear to do much harm to the birds.* Nevertheless, animals should be kept from access to the sprayed locality until after several showers, and the poisoned insects should be supplied in small quantities only, if at all, to poultry, etc., as there is undoubtedly some risk of poisoning, for arsenic is not a substance which is readily eliminated from the carcass by decomposition, as some poisonous substances are.

The arsenite of soda employed for this and other purposes may be prepared by boiling "white arsenic," *i.e.*, arsenious oxide with one third of its weight of caustic soda, or even four times its weight of sodium carbonate (washing soda), and water until it dissolves, or it may more

* Annual Report of the Entomologist, 1904-5, p. 343, also this journal, vol. III, p. 573.

conveniently be procured already prepared in the form of a white solid (or in the case of that used by the Division of Entomology, a greenish solid, coloured by the addition, on our recommendation, of a small quantity of Paris green). About 9 ounces of "white arsenic" is equivalent to 1 lb. of sodium arsenite. The sugar in the above formula is intended to make the poisoned material more attractive to the insects, and aids also in increasing the quantity which adheres to the grass or other vegetation.

Arsenic is also used for the destruction of caterpillars, grubs, etc., particularly on fruit trees. In this case the use of arsenious oxide, arsenite of soda, or other readily soluble compound, is excluded, because of the injury which such substances produce on the foliage. Several almost insoluble compounds of arsenic are therefore employed, the following being the favourites :—

Paris Green, "Schweinfurth's Green" or "Emerald Green."—An impure arsenite and acetate of copper usually containing from 30 to 50 per cent. of arsenious oxide (in combination), but of very variable composition; it often contains a portion (2 per cent. or more) of its arsenic in a soluble form. The best samples for spraying are those which contain the least soluble and the most insoluble arsenic. It is used in suspension in water and applied by means of a spray pump, usually at a strength of one part of the solid in 2000 or 3000 of water. Obviously to ensure good results the liquid must be kept in constant agitation, otherwise the Paris Green will settle to the bottom. The injury to foliage due to the presence of soluble arsenic may be prevented by the addition of an equal weight of lime.

London Purple.—A mixture of arsenite of lime with colouring matter, obtained as a bye-product in the manufacture of certain coal-tar dyes. It, like Paris Green, is very variable in composition, but usually contains from 30 to 50 per cent. of arsenious oxide, of which often a considerable proportion is soluble in water. It is used in the same manner as Paris Green, but unless lime be also added, is even more liable to injure foliage. An arsenite of lime can be made by dissolving arsenite of soda in water, diluting largely, and then stirring in milk of lime containing about 10 times the weight of lime as of arsenite of soda taken. The lime is in large excess, but does no harm.

Lead Arsenate.—Which is insoluble in water, and therefore does not injure foliage, is very valuable as a spraying material. It can be bought ready prepared, or can be made as required from "sugar of lead," *i.e.*, acetate of lead and *arsenate* of soda, 11 oz. of the former and 4 oz. of the latter, dissolved in separate portions of water, give when mixed, a fine white precipitate of arsenate of lead, which, when suspended in 150 gallons of water, can be sprayed on trees without fear of injury. Arsenate of Lead is supplied either as a paste (usually containing about 12 per cent. arsenious oxide) or in powder. The former gives the better results (Lounsbury).

Scheele's Green.—Copper hydrogen arsenite is also sometimes used for spraying. Like Lead Arsenate, it is very slightly soluble in water,

and therefore has but little injurious action on foliage. It is, however, not often used as an insecticide.

Caution as to Use of Arsenical Preparations.—Arsenic compounds are so poisonous to man and the higher animals that it is of the utmost importance that they be used with care. Every precaution should be taken to prevent access of any of the arsenical solutions, etc., to foods, water, etc., which may afterwards be consumed by animals. The lethal dose depends very largely upon the individual, for man it has been given as probably 1 or 2 grains, for a horse perhaps 30 grains, for a cow 10 or 15 grains, for a dog about 1 grain. Authorities, however, differ very greatly as to the lethal doses.

As antidotes, emetics should be given, followed by a dose of recently precipitated ferric hydrate prepared as required by adding ammonia or carbonate of soda to a solution of ferric chloride ("perchloride of iron"). Milk and eggs, olive oil or barley water are also useful.

Other poisonous subjects sometimes used as insecticides are:—

Carbolic Acid, Phenol—C_6H_5OH.—The pure substance is a white crystalline solid, but the crude product generally used, is a liquid with a characteristic smell, soluble in about 15 times its weight of water. It is a violent poison, both to animals and plants, and as an insecticide has to be used with care in order to avoid injury to vegetation. On dormant fruit trees, a wash containing about 1 lb. of the crude acid, 2 or 3 lb. of soft soap, and 2 gallons of water is sometimes used to destroy boring insects. A solution of carbolic acid is also sometimes used for preventing the attacks of insects, *e.g.*, the warble fly, on cattle.

On account of its poisonous action on plants it is probably not safe to use solutions stronger than 0.5, or at the most, one per cent. It should not be allowed to touch the foliage.

Alkaline Sulphides.—These are very effective insecticides, but are also poisonous to the roots of plants, and corrosive to foliage. "Sulphide of Potash" or "Liver of Sulphur" is really a mixture of sulphide and polysulphides of potassium, and is used for spraying trees at a strength of from 2 to 4 per cent.

More largely used is the sulphide of calcium, generally prepared as required by boiling lime and sulphur with water. The resulting yellow liquid contains in solution a mixture of various sulphides of calcium, and often some free lime. This "Lime and Sulphur" wash or dip is largely used, both by the horticulturist for the destruction of scale and other insects on trees and by the sheep farmer for killing insect parasites, especially scab on his animals. For the former, the usual plan is to boil sulphur and lime with water for some time until the sulphur is converted into calcium sulphides and so dissolves, and then to dilute to the desired strength. Common salt is also often added. There are many formulæ recommended, according to the particular plant and kind of insect to be dealt with. Thus, a mixture for fruit trees is made by boiling 10 lb. of quick lime with 20 lb. sulphur in about 20 gallons of water for about two hours, then mixing this with 40 gallons of water, in which 30 lb. of lime and 15 lb. of common salt have been dissolved. This wash must only be used in winter when the leaves are off.

For scab in sheep the so-called "lime and sulphur dip" has some strong partisans, especially in Cape Colony.* However, it may be prepared (and the variations in the proportions of lime, sulphur, and water appear to be very great—thus to 100 gallons of water quantities of lime varying from 4½ lbs. to 20 lb., of sulphur from 15 lb. to 25 lb., are recommended by various correspondents, and the ratio of lime to sulphur varies from 1 : 1 to about 1 · 5), there can be little doubt that the dip is injurious to wool. All alkalies and alkaline sulphides have a strong caustic action on such organic substances as hair and wool, as is evidenced by the use of calcium sulphide in strong solution, for removing hair, both for toilet purposes and also, on the larger scale, from skins prior to tanning. But, if the injury to the quality of the wool can be excused, there appears to be strong evidence in favour of the efficacy of the dip as a remedy for and preventative of scab.

It is of importance, however, to understand the principles of its preparation. As already stated the really active ingredient is the calcium sulphide and polysulphide, though the free sulphur doubtless would be useful, especially as a preventative of re infection. This free sulphur, however, can only be applied to the wool, if the dip is well stirred during the operation of dipping, since it is quite insoluble in water, and this practice is rarely followed. When lime is boiled with sulphur the reaction results in the formation of calcium sulphide and calcium thiosulphate, as indicated by the equation.—

$$\underset{\text{lime}}{3\,CaO} + \underset{\text{sulphur}}{4\,S} = \underset{\substack{\text{calcium}\\\text{sulphide}}}{2\,CaS} + \underset{\substack{\text{calcium}\\\text{thiosulphate}}}{Ca\,S_2\,O_3}$$

The calcium monosulphide, CaS, can, however, dissolve an additional quantity of sulphur to form, finally, calcium pentasulphide—$Ca\,S_5$, thus—

$$Ca\,S + 4\,S = Ca\,S_5$$

So the maximum amount of sulphur which can be dissolved by boiling with lime and water is indicated by the equation.—

$$3\,CaO + 12\,S = 2\,Ca\,S_5 + Ca\,S_2\,O_3$$

taking atomic weights, $Ca = 40$, $O = 16$, $S = 32$.

$$\underset{\text{168 lime}}{3\,[40 + 16]} \qquad \underset{\text{384 sulphur}}{12 \times 32}$$

168 parts of pure lime can thus bring about the solution of 384 parts of sulphur, *i.e.*, one part by weight of lime suffices to dissolve 2·28 parts of sulphur, or one pound of sulphur requires 0·4375 lb. of pure lime. Now ordinary lime is never pure; the proportion of real lime present varies from as low as 50 per cent., or even lower, to as high as 98 per cent. or higher. Hence those recipes giving lime to sulphur in less proportion than 1 to 2. even if the lime be of good quality, must leave a large proportion of the sulphur undissolved. With usual qualities of lime the amount of sulphur in excess will be still greater, and when, as is generally recommended, the liquid is allowed to settle and only the clear portion used for dipping, this sulphur is wasted. It is, on the other hand, desirable to avoid excess of lime in the dip, otherwise the injury to the wool becomes greater.

* See Correspondence in *Cape Agricultural Journal*, March to August, 1905.

The proper proportions of lime and sulphur to use will depend greatly upon the purity of the former. If the lime is white, freshly burnt and slakes with considerable heat when water is added, it is probably fairly pure, and 1 part of lime to about 2¼ parts of sulphur will be about the right proportion. But if "blue lime" be used, and especially if it be "air-slaked," *i.e.*, has been kept for some time, equal weights of lime and sulphur will probably be better. In any case, it will be safer to see that there is, at the end of the boiling, a *little* sulphur undissolved, as this makes it less likely that there is excess of lime in the liquid.

Of course, in preparing 100 gallons of the dip the lime should be treated with only about 5 to 10 gallons of water, heated to boiling, the sulphur added in fine powder, little by little, and the whole boiled for about two hours or until most of the sulphur has disappeared. This strong solution of calcium sulphides and thiosulphate is then diluted to the 100 gallons with water.

The dip should be used as soon after preparation as possible, as it absorbs carbon dioxide and oxygen from the air, and the calcium sulphide and penta-sulphide are decomposed. Many users have obtained better results by using the dip at a temperature of about 100° to 110° F. (38° C. to 43° C.). Each animal should remain at least two minutes in the dip.

Tobacco (*Nicotiana tabacum*).—Contains the alkaloids *nicotine*, $C_{10}H_{14}N_2$, *Nicoteine* $C_{10}H_{12}N_2$ and *Nicotelline* $C_{10}H_8N_2$ which are soluble in water and intensely poisonous and obnoxious to animals, including insects. Tobacco may be used in three ways as an insecticide :—

1. In the dry state in the form of fine dust (snuff is often effective).
2. In the liquid form as an aqueous extract.
3. By volatilising nicotine or tarry products by heat and producing a poisonous atmosphere.

As the subject was fully discussed in this Journal. Vol. IV., pp. 536 to 549 further reference here is unnecessary.

One remark, however, may be made as to the alleged poverty of Transvaal tobacco in nicotine. Accepting the determinations of nicotine in the analyses quoted as correct, it must be remembered that in the process of fermentation as carried out in this Colony, the tobacco is subjected to such treatment as must necessarily deprive it of a very considerable proportion of nicotine. I believe the usual plan is to actually immerse the dried leaves in water, allow them to drain and then pile the wetted tobacco in heaps for fermentation. A considerable proportion of nicotine must thus be removed by the water before fermentation begins. In other countries, this immersion in water is replaced by merely sprinkling or spraying with water, if the dampness of the atmosphere does not impart sufficient moisture. Most of our Transvaal tobacco has thus already had its nicotine partially extracted. Unless this fact is kept in mind, one is apt to condemn without full justification, the prospects of profitably producing extract from Transvaal grown tobacco.

Hellebore (*Veratrum album*).—The root of this plant contains several alkaloids, of which *Veratrine* $C_{32}H_{49}NO_9$, *protoveratine*, $C_{32}H_{51}NO_{11}$ and *Jervine*, $C_{26}H_{37}NO_3$ are poisonous to animals. It is occasionally used

as an insecticide, either in the dry, finely powdered state, often mixed with flour, or in water, about an ounce to three gallons of water. It is efficacious against leaf growing insects, and is not so poisonous to animals or man as the arsenites.

Insect Powder.—The finely powdered flower-heads of a plant—two species of the plant are used—*pyrethrum roseum*, the product from which is known as Persian or Caucasian insect powder, and *pyrethrum cinerariæfolium*, which yields Dalmatian insect powder or "Buhach," as it is called in California. The Dalmatian product is said to be more effective than the Persian. It can be used dry, often mixed with three times its weight of flour, or in aqueous or alcoholic solution; also in fumigation. The substance can be used to destroy aphides, house insects of various kinds and, especially by fumigation, for driving away mosquitoes and flies. For spraying solution 1 oz. of the powder is mixed with 2 or 3 gallons of water, a little alcohol is sometimes first added to the powder and the mixture then diluted with water. Additions of ammonia and of soap to the liquid are sometimes made, and are said to increase its efficiency. For fumigation, the powder is scattered on hot coals or on a hot metal plate; this, of course, can only be effective in a closed space.

Several other vegetable products, *e.g*, quassia chips, are used as insecticides, but their importance is not sufficient to justify detailed description here.

Other insecticides are substances which are more commonly used as disinfectants or antiseptics. To this category, belong many coal-tar products—carbolic acid, Lysol, Izal, Jeye's disinfectant, creasote, and many others.

Quick Lime, Calcium oxide, CaO, is sometimes used for killing snails, slugs, caterpillars, etc. It is only effective for this purpose when fresh and unslaked, and is best applied as fine powder, dusted on to the slugs or caterpillars.

Lime water, too, is useful as a destroyer of many caterpillars and worms—lime will only dissolve in water to the extent of about 0·13 per cent., *i.e.*, a gallon of water will only dissolve about one-fifth of an ounce of quick lime.

Lime-wash, *i.e.*, about 2 lb. of lime to the gallon of water, is also used, as a remedy against scale insects, being applied to the bark of the trees.

B.—For poisoning the atmosphere breathed by the insects, the principal substances used are the following:—

Carbon Disulphide—$C\,S_2$ "bisulphide of carbon," a colourless, heavy very refractive liquid, possessed of a strong, disagreeable odour, recalling that of rotten cabbage. When perfectly pure, however, it has a pleasant ether-like smell.

Carbon disulphide is very volatile, and its vapour is very inflammable, becoming ignited, when mixed with air at temperatures much lower than those required to set fire to most combustibles. A mixture of air and carbon disulphide vapour is explosive, and may be ignited even by a glowing pipe or cigar. The vapour is heavy and very poisonous to animals, including insects.

On account of the heaviness of its vapour it is particularly well adapted for killing subterranean insects or larvæ. It is often used for destroying ants. One or two ounces of the liquid poured down the holes, which should then be covered, will evolve a poisonous vapour which may penetrate into all parts of the nest.

It can also be used for the destruction of weevils in mealies or other grain. For this purpose the grain is placed in bins or tanks, sufficient carbon disulphide, either poured on to the grain or placed in a vessel on the top and the bin or tank closely covered.

Insects on low growing shrubs or trees may be destroyed by surrounding the trees with boxes to enclose the heavy vapour given off from a small quantity—half an ounce to an ounce—of the liquid placed in the saucer.

Sulphur Dioxide—SO_2, a heavy poisonous gas, possessing a suffocating odour, and poisonous to both animals and plants. It is most readily formed by burning sulphur in air. It cannot be used to destroy insect pests on plants, but is often employed for the destruction of bugs, cockroaches, and other household insects. It is also employed as a disinfectant.

Tobacco Smoke, or better, the fumes from tobacco extract, are often used as an insecticide in greenhouses, etc.

Hydrocyanic Acid HCN, "Prussic acid," a gas with a curious and characteristic, though not strong odour, is intensely poisonous to animals, and as it, in small quantities, is not fatal to plants *in the dark*, can be and is extensively used for the destruction of insect pests on shrubs and trees. The gas is made as required by the action of diluted sulphuric acid upon potassium cyanide. The reaction is:—

$$\underset{\text{cyanide}}{\underset{\text{potassium}}{KCN}} + \underset{\text{acid}}{\underset{\text{sulphuric}}{H_2SO_4}} = \underset{\text{acid sulphate}}{\underset{\text{potassium}}{KHSO_4}} + \underset{\text{acid}}{\underset{\text{hydrocyanic}}{HCN}}$$

Fairly pure cyanide, now easily obtainable (98 per cent. potassium cyanide) and ordinary oil of vitriol, are suitable for the purpose. Before use, the acid should be diluted with about one and a half or twice its volume of water. The proportions to use are about one part by weight of potassium cyanide to one and a half parts of sulphuric acid and two or three parts of water. The water should be placed in a glass or earthenware vessel, the sulphuric acid poured gradually in with continuous stirring, and lastly, when all is ready, the cyanide should be dropped in and the building or tent at once vacated.

For trees, a tent made of canvas, rendered gas-tight by treatment with boiled linseed oil, is used to retain the gas and the fumigation done at night. Usually from 30 to 40 minutes' exposure to the gas is sufficient. It is hardly necessary to point out the necessity of the greatest care in dealing with such intensely poisonous substances as potassium cyanide and prussic acid. Caution to prevent breathing air containing the acid is particularly necessary.

This method is also very successful in ridding houses, mills, etc., of insect pests of all descriptions. For trees the amount of cyanide to use is from 10 to 25 grammes, *i.e.*, from $\frac{1}{3}$ to $\frac{7}{8}$ oz. per 100 cubic feet of air space, depending upon the kind of trees. For buildings about 1 oz. per 100 cubic feet will generally be sufficient.

C.—*The so-called Contact Poisons.*—These are intended particularly for sucking insects, which, deriving their food from the interior of the host plant or animals, cannot be killed by poisoning their food. They, therefore, are destroyed either by clogging the breathing pores by some liquid or solid, or, in some cases perhaps, by absorption of the poison through the skin.

Soap of any kind, and particularly potash or soft soap, is effective, being usually applied in from 5 to 20 times its weight of water.

Resin soaps are also employed, being made as required by boiling resin with caustic soda or potash solution, or even with sodium carbonate (washing soda) solution, generally some fish-oil or tallow is also used.

Thus a common wash is made by taking—

Resin	20 lb.
Fish oil	½ to 1 gallon
Caustic soda	8 lb.

These are placed in a boiler with a few gallons of water and heated to boiling, then gradually cold water added and kept boiling for about two hours until there are about 30 gallons, and all is dissolved. Then diluted to 100 gallons with soft water. Sometimes potash is substituted for soda, and tallow for fish oil, and occasionally petroleum is also added. If both the potash and soda are equally pure, 56 of potash are equal to 40 of soda.

Paraffin or petroleum emulsion is also very effective. It can be made with either soap solution or sour milk. For the former 1½ lb. of soap are dissolved in 2½ gallons of hot water, then 5 gallons of paraffin are added and the whole violently agitated by a spray pump until an emulsion is formed. One gallon of the emulsion is then diluted with from 9 to 12 gallons of water. The effect of the soap is merely mechanical, and the petroleum is not in any sense dissolved, but merely broken up into minute droplets and suspended in the water.

One gallon of sour milk to two gallons of paraffin may also be emulsified and afterwards diluted with water before spraying.

Some of the substances described under A. also act as contact poisons, being probably absorbed by the insect through the skin. This is often the case with arsenic dips, calcium sulphide, sulphur, etc., when used for blood or sap-sucking insects.

II.—Animal Poisons.

These are not of great importance to the farmer. They are chiefly used for the destruction of vermin or injurious animals, *e.g.*, rats, jackals, etc. A very large number of substances might be used, but they cannot be appropriately described here.

III.—Fungicides.

These are substances which are destructive to the lower forms of plant life—*fungi*, including moulds, bacteria, etc. They are thus really plant poisons, but the delicate cell-walls of fungi render them much more susceptible than the thicker coverings of the higher plants, to the action of poisons It is thus often possible to destroy parasitic fungi, by

solutions of plant poisons too dilute to injure the host plant. A great many substances may be used as fungicides. Among the more important are the following:—

Copper Salts.—Soluble copper salts are extremely poisonous to plants, though insoluble copper compounds are not injurious and are often assimilated by plants.

The starting point of most preparations of copper and the most important commercial salt is *copper sulphate*, $CuSO_4$, $5H_2O$, commonly known as "blue vitriol," or "blue stone." This is a bright blue, crystalline substance, dissolving easily in water to form a blue solution.

The substance has long been used for dressing seed wheat for the prevention of the fungoid diseases, smut and rust. Each quarter of corn receives 2 gallons of water, containing 2 lb. of sulphate of copper, and the whole is shovelled about so as to ensure that each grain becomes wetted with the liquid. The dressing is usually applied about 24 hours before the seed is sown. The spores of the fungi are destroyed, and the copper salt is soon converted into insoluble and harmless compounds in the soil. An American plan is to soak the seed in 24 gallons of water, containing 1 lb. of copper sulphate, for 12 hours, and then for 5 minutes in lime water.

Copper sulphate in about 0.5 per cent. solutions, *i.e.*, ½ lb. to 10 gallons of water, is also sometimes used for spraying plants to prevent fungoid diseases, but it is apt to injure foliage. In Europe it has been largely employed during the last eight or nine years for the destruction of a cruciferous weed—charlock -in barley or oats The whole field is sprayed with a 2 or 3 per cent. solution at the rate of about 40 gallons to the acre, while the charlock plants are young. The charlock is killed, while the barley and clover are not injured by the spraying.

But copper sulphate is too corrosive in its effect on foliage to be very suitable as a fungicide for many plants, and a much more generally used substance is copper hydroxide, $Cu\,H_2O_2$, applied in suspension in water.

This is largely used under the name of "Bordeaux mixture," and is made as required by the action of slaked lime upon sulphate of copper:—

$$\begin{array}{ccccccc} CuSO_4 & + & CaH_2O_2 & = & CuH_2O_2 & + & CaSO_4 \\ \text{copper} & & \text{lime} & & \text{copper} & & \text{calcium} \\ \text{sulphate} & & & & \text{hydroxide} & & \text{sulphate} \end{array}$$

Various strengths have been recommended, usually from 12 to 30 lb. of copper sulphate to 100 gallons of water and from 8 to 20 lb. of quick lime.

Of the pure substances, 239 parts of sulphate of copper require only 56 parts of quick lime, but in practice, as the lime is never pure and portions of it never dissolve, much more lime has to be employed. The mixing of the lime and copper sulphate must always be done in the cold, and there should always be a slight excess of lime. This can be ascertained by filtering the muddy blue liquid and testing it for dissolved copper or lime. The simplest plan for the former is to immerse a piece of polished steel—a knife blade for example—in the liquid for a few minutes. If there be excess of copper sulphate a stain of metallic copper will appear on the steel. To show excess of lime in the solution the easiest plan is

to breathe on the surface when the carbon dioxide in the air from the lungs will form a thin scum of carbonate of lime. A much used formula is :—

Copper sulphate	6 lb.
Quick lime	6 lb.
Water	50 gallons.

Each of the solid constituents should be dissolved in 25 gallons of water and then thoroughly mixed together. The mixture should be used as soon after its preparation as possible, since it must be remembered that the effective ingredient—copper hydroxide—is in suspension not in solution. Other copper preparations used as fungicides are :—

Eau Celeste.—Ammonio-copper sulphate, $Cu\ SO_4 \cdot 4\ NH_3\ HO_2$ made by adding ammonia to a solution of copper sulphate. This yields a magnificent blue solution. The usual proportions are copper sulphate, 5 lb., ammonia (strong), 6 or 7 pints, water 100 gallons.

Ammoniacal Copper Carbonate.—Made by dissolving 10 ounces of copper carbonate in about 6 pints of strong ammonia and diluting to 100 gallons with water. A deep blue solution. In the two latter preparations, the copper is in solution, and the liquids have the advantage of not discolouring the fruit and foliage so much as Bordeaux mixture.

Mercuric Chloride.—$Hg\ Cl_2$ "Corrosive sublimate," is an extremely powerful poison both to animals and plants. It has been used as a fungicide against bunt in wheat and for other purposes. A very dilute solution suffices—about 1 lb. in 50 or 100 gallons of water. Its violent poisonous qualities render it necessary to take every precaution in dealing with this substance.

Formaldehyde.—$H_2\ CO$, used in the form of a solution in water—"formalin"—containing about 40 per cent. of the real substance. It is an excellent fungicide and disinfectant, and is being more and more used. But as it is also a violent poison to plants it has to be used with care.

A solution containing 0·1 per cent. of the real substance, *i.e.*, about 1 quart of formalin to 100 gallons of water, has been recommended as effective for destroying fungi and their spores on grain, clover seeds, etc. An hour's immersion of the seed in this solution is recommended.

As a preventative of scab in potatoes, immersion for an hour of the "sets" in a solution containing 1 pint of formalin in 30 gallons of water is said to be effective. This solution would contain about 0·167 per cent. of the real formaldehyde.

IV.—PLANT POISONS.

These are sometimes useful to kill weeds. A large number of substances act as poisons to plants. Among those which have been most largely used are the following :—

Arsenic and Arsenite of Soda.—These have been described under insecticides. About 1 lb. of arsenious oxide or 1½ lb. of arsenite of soda to 10 gallons of water is the strength often used. If arsenious oxide be used it should be dissolved by boiling with water and about 2 lb. of soda. It should be applied in dry weather, and care be taken to keep cattle off the treated vegetation.

Salt.—Hot brine—1 lb. of salt to 1 gallon of water is a useful weed killer.

Calcium Sulphide (or any soluble sulphide, *e.g.*, fresh "gas lime") is a powerful plant poison. For this purpose it is advisable to use excess of lime so as to save waste of sulphur. Two lbs. of sulphur, 10 to 20 lb. of quick lime and 10 gallons of water, boiled for an hour or two, are suitable quantities to use.

Sulphuric Acid.—Oil of vitriol diluted with about 30 parts of water will kill weeds. Care must be taken that the acid does not come into contact with iron vessels or be spilt on clothing, etc.

Carbolic Acid, Phenol.—An ounce of the commercial acid to a gallon of water will kill plants as well as insects.

All these substances render the soil barren for some time afterwards. With heavy rains, however, they will soon wash out. Additions of lime to the soil would cure the acidity due to sulphuric acid.

V.—Antiseptics and Disinfectants.

An antiseptic is a substance which prevents the growth of micro-organisms which give rise to putrefaction, disease or chemical changes. A disinfectant is a substance which not only behaves as an antiseptic, but also destroys the organisms and their spores. Disinfectants usually act in one of the following ways :—

1. They combine with albuminoids to form insoluble compounds. They, therefore, either precipitate some of the food of the micro-organisms or may even act upon the protoplasm contained in their bodies.
2. Some substances remove oxygen from the medium and thus kill those organisms which require oxygen.
3. Oxidising agents, *e.g.*, chlorine, permanganates, etc., destroy, by oxidation, both the micro-organisms and their food.
4. Some substances seem to have a specific germicidal action for no apparent reason. To this class, boric acid and the borates belong.

By a disinfectant is generally understood a substance used for destroying noxious micro-organisms in substances which are not used as food, while by an antiseptic is usually meant a substance used to arrest putrefactive changes without rendering the substance to which it is applied injurious or obnoxious to animals. On the farm, the chief use of disinfectants is for destroying the risk of infection after outbreaks of contagious diseases.

The following are the chief powerful disinfectants suitable for this purpose :—

Bleaching Powder or "Chloride of lime," Ca (OCl) Cl. This substance may be used in two ways :—

(1) By evolving hypochlorous acid, HClO, which is a powerful oxidising agent, and quickly destroys putrescible matter and bacteria.

By simply moistening any articles with a solution of bleaching powder and exposing them to the air, hypochlorous acid is slowly evolved by the action of the atmospheric carbon dioxide—

$$2\ Ca\ (OCl)Cl + CO_2 + H_2O = CaCl_2 + CaCO_3 + HClO$$

(2) By evolving chlorine gas, which is a powerful deodorant and disinfectant. This can be brought about by treatment of bleaching powder with any acid, *e.g.*, diluted sulphuric acid—

$$Ca\ (OCl)Cl + H_2SO_4 = CaSO_4 + H_2O + Cl_2$$

If a building is to be disinfected by chlorine, about 2 lb. of bleaching powder to each 1,000 cubic feet of space should be placed in an earthenware bowl or vessel, and a cooled mixture made by pouring 1½ lb. of sulphuric acid (oil of vitriol) into a gallon of water, poured upon it, and the doors, windows, all crevices, etc., closed as quickly as possible. These quantities will yield chlorine enough to form nearly 0·5 per cent. of the atmosphere in the room, and will suffice, if left for 12 hours or so, to kill all micro-organisms, though possibly not their spores. As the gas is very injurious to breathe, care should be taken to well ventilate the room after fumigation before it is entered.

Sulphur Dioxide, SO_2, has already been referred to under insecticides. It is also a good disinfectant, and is often used for fumigating stables, cow-houses or dwelling-houses. It is generally made as required by burning sulphur in air. About 1 lb. per 1,000 cubic feet of air space is a suitable quality. The sulphur can be obtained in the form of "candles," *i.e.*, short cylindrical cakes provided with a wick, or roll sulphur may be placed in an iron dish, moistened with a few drops of carbon disulphide, and can then be readily ignited with a match or taper. Without the carbon disulphide it is rather troublesome to ignite.

Carbon Disulphide, $C\ S_2$, already described as an insecticide, is also possessed of disinfecting powers, and is sometimes used for this purpose.

Phenol, $C_6\ H_5\ OH$.—Carbolic acid and Cresol, $C_6\ H_4\ (CH_3)\ OH$, obtained from coal and wood tar, are largely used for disinfecting purposes. They are employed either in liquid form (solutions in water, often with the aid of alkalies—potash or soda) or in powder consisting of some indifferent powder—silica, silicates, lime or magnesia—containing about 15 per cent. of the real carbolic acid.

Creasote, which contains Cresol $C_6\ H_6\ OH\ (CH_3)$, and xylenol $C_6\ H_3\ (CH_3)_2\ OH$, is often used for preventing decay in timber.

Lysol is an alkaline solution of tar-oils and fat. It is soluble in water and owes its disinfecting powers mainly to cresol.

Jeyes' Disinfectant and Creolin are similar substances.

Izal is a reddish brown liquid obtained in the manufacture of coke, and is a good disinfectant.

Wood Creasote is obtained from the tar produced by the distillation of wood, and contains phenol, cresol, guiacol, $C_6\ H_4\ (O\ CH_3)\ OH$ and creosol $C_6\ H_5\ (CH_3)\ OCH_3\ OH$. It has, therefore, disinfectant properties. "Little's soluble phenyle" is said to be made from wood creasote.

Formalin, already described as a fungicide, is an excellent disinfectant and antiseptic, but is too costly to be used much for disinfecting purposes.

As an antiseptic, however, it is largely used in the preservation of food stuffs, especially milk, butter, and cream. But as its presence in these substances is believed to have an injurious effect on their digestibility, it is not desirable that it should be much used in this direction.

The above are more or less volatile substances, and therefore exert a disinfecting action upon substances near, but not actually in contact with, the liquid or solid substance.

The following are non-volatile, and therefore are only effective upon the substance, which they or their solution actually touch.

Potassium Permanganate, $K\,MnO_4$ and *Manganate* $K_2\,MnO_4$, are extremely powerful oxidising agents, and in solution (deep purple with the former and green with the latter) form effective deodorisers and disinfectants. They are the active ingredients in "Condy's Fluid."

Copper Sulphate, $CuSO_4\,5H_2O$, already described as a fungicide, is an efficient disinfectant in solution, but is somewhat expensive.

Zinc Chloride, $ZnCl_2$ and *Mercuric chloride*, $HgCl_2$, are also excellent disinfectants. A strong solution of the former, known as Burnett's Disinfecting Fluid, is used as a wood preservative. The latter is open to objection, because of its violent poisonous properties.

As antiseptics several substances, in addition to those described under disinfectants, are employed. Among these the following are employed :—

Boric Acid or *Boracic Acid*, $H_3\,BO_3$, a sparingly soluble, crystalline, solid substances, almost devoid of taste. It is often employed as a preservative of food stuffs, *e.g.*, milk, cream, etc., and in surgery.

Borax, $Na_2\,B_4\,O_7$, $10H_2O$, is used for a similar purpose, and sometimes as a poison for cockroaches.

Salicylic Acid, $C_6H_4(OH)$, COOH, is also sometimes added as a preservative to milk, cream, canned fruits, fruit syrups, etc.

* * * *

NOTES FROM THE CHEMICAL LABORATORIES.

Among the many substances examined in the laboratories during the past three months, the following yielded results which may be of general interest :—

Soils.

A.—A sample of soil from "Florence," Lake Chrissie, was obtained from Mr. J. W. Grimes. In this district, I am told, the average soil is of but poor quality, but the sample proved rich in all

the necessary constituents of plant food with the exception of lime. The analytical data were as follows :—

	Per cent.
Stones retained by 3 m.m. sieve	0.74
Moisture	1.31
*Loss on ignition	6.87
Insoluble matter	76.31
Iron oxide and alumina	14.93
Lime	trace
Magnesia	0.10
Potash	0.12
Phosphoric acid	0.22
	99.86
*Containing nitrogen	0.137
"Available" potash	0.0064
"Available" phosphoric acid	0.0073

The nitrogen and total phosphoric acid are unusually high for soils in this Colony, but the soil is almost destitute of lime. The addition of 300 or 400 lbs. of good white lime per acre would probably render this soil very productive, as it would favour the nitrification of the organic matter, and doubtless increase the availability of the phosphoric acid. At present, the figure for "available" phosphoric acid—0.0073 per cent.—is somewhat low, though the total phosphoric acid present—0.22 per cent.—is unusually high. The potash content is not, perhaps, as high as in the average of the Transvaal soils we have examined, and potash manures, *e.g.*, wood ashes, might prove beneficial.

B.—Three samples from the farm "Misgund" in the Klip River Valley, about ten miles south-west of Johannesburg, were sent by Mr. Ormiston Reid.

The result of their analysis were as follows :—

	No. 1. (reddish loam.)	No. 2. (red loam.)	No. 3. (grey soil.)
Stones retained by 3 m.m sieve	0.73	0.56	none
Moisture	2.09	1 39	2.92
*Loss on ignition	9.01	7.82	9.11
Insoluble matter (sand, etc.) ..	68.37	74 03	69.21
Iron oxide and alumina ..	19.76	15.25	17.99
Lime	0.19	0.08	0.78
Magnesia	0.07	0.03	0.32
Potash	0.19	0.22	0.16
Phosphoric acid	0.07	0.11	0.04
	99.75	98.93	100.53
*Containing nitrogen	0.130	0.132	0.102
"Available" potash	0.0056	0.0132	0.0014
"Available" phosphoric acid..	0.0216	0.0154	0.0084

All three samples were rich in nitrogenous organic matter. No. 3 is evidently in need of phosphates and potash, while Nos. 1 and 2 would be improved by a dressing of lime. On No. 3, superphosphate at the rate of about 200 lbs. per acre, and sulphate of potash 100 lbs. per acre, would probably be profitable, while No. 2 should be very fertile after the addition of about 300 to 400 lbs. of good white lime per acre.

C.—Three samples of soil from Tweefontein, near Balfour Station, were received from Mr. W. E. McLelland for analysis. They were all from irrigated lands which have been cultivated for some years.

No. 1 was a rich red soil taken from lands which had grown satisfactory crops of tobacco and rye grass.

No. 2 was a dark grey soil from land which lies somewhat in a hollow and which had grown oats and wheat.

No. 3 was also a grey soil from land at a higher elevation than the others—the sub-soil is sticky when wet, though the soil itself is friable. Has grown mealies and forage for a number of years. Potatoes, tried one year, were not successful.

The number obtained on analysis were as follows :—

	No. 1	No. 2.	No. 3.
Stones retained by 3 m.m sieve	0.34	none	none
Moisture	0.92	1.52	3.56
*Loss on ignition (organic matter, etc.)	3.73	6.93	6.48
Insoluble matter (sand, etc.)..	88.61	88.04	79.82
Iron oxide and alumina ..	6.28	3.57	8.18
Lime	0.22	0.13	0.95
Magnesia	0.08	0.05	0.40
Potash	0.07	0.13	0.16
Phosphoric acid	0.10	0.09	0.07
	100.01	100.46	99.62
*Containing nitrogen ..	0.126	0.197	0.286
"Available potash	0.0155	0.0042	0.0069
"Available" phosphoric acid..	0.0191	0.0191	0.0068

The soils are thus rich in nitrogen and well supplied with lime, especially No. 3. They are all low in potash, No. 1 being very poor in total though rich in "available" potash. No. 3 needs phosphatic manures—superphosphate, bones or basic slag—while No. 2 would probably respond to a dressing of lime. The low value for "available" potash in No. 2 indicates the desirability of potash manures—best, wood-ashes or sulphate of potash.

D.—Two soils from near Welge River Station were examined—one was a red, very sandy soil, the other a black soil. The results were as follows :—

Neither sample contained any stones retained by a 3 m.m. sieve.

	No. 1. (Red soil.)	No. 2. (Black soil.)
Moisture	0.28	1.18
*Loss on ignition (organic matter, etc.)	1.03	5.35
Insoluble matter (sand, etc.)	94.93	88.98
Iron oxide and alumina	3.18	3.36
Lime	0.13	0.09
Magnesia	0.02	0.04
Potash	0.05	0.27
Phosphoric acid	0.05	0.08
	99.61	99.35
*Containing nitrogen	0.033	0.175
"Available" potash	0.0173	0.0248
"Available" phosphoric acid	0.0155	0.0214

Both soils are thus mainly sand, plant food being extremely small in quantity, especially in No. 1. On the other hand, the potash and phosphoric acid present are both in a very readily available state, so that, for a time, the soils might yield fair crops. Obviously, however, the store of plant food would soon be exhausted. No. 1 needs potash, phosphoric acid and nitrogen, while, in No. 2, lime would probably be most profitable.

E.—A composite sample from the orchards of Sir George Farrar's "Bedford Farm," near Johannesburg, on May 8th, 1906, gave the following figures on analysis :—

Stones retained by 3 m.m. sieve .. .. 2.26 per cent.

The rest of the soil contained :—

Moisture	0.26
*Loss on ignition (organic matter, etc.) ..	3.89
Insoluble matter (sand, etc.)	88.32
Iron oxide and alumina	6.58
Lime	0.16
Magnesia	0.09
Potash	0.26
Phosphoric acid	0.03
	100.19
*Containing nitrogen	0.059
"Available" potash	0.0118
"Available" phosphoric acid	0.0130

This soil, like so many of our Transvaal soils, is poor in nitrogen, phosphates and lme, though well supplied with potash. The trees—apples, pears, plums, peaches, apricots, nectarines and cherries—have been planted twelve years, and the land has received no manure. With the exception of the apples, all have done well and without irrigation. The surface soil is kept constantly stirred, and the high figures for "available" potash and phosphoric acid in proportion to the total

amounts of these constituents is doubtless due to this good cultivation. The soil would probably be improved by the addition of phosphates, lime and bulky organic manure, *e.g.*, kraal manure or, perhaps, better, by green manuring, *i.e.*, growing some quick-growing crop—oats, mustard or clover—and ploughing it in when about half-grown. As a source of phosphates and lime, basic slag at the rate of 200 to 300 lbs. per acre would probably be best, or a dressing of 300 lbs. of good white lime, followed by 200 lbs. of superphosphate and well harrowed in.

Old Native Kraal Manure.

A specimen was sent by Mr. J. W. Schoeman procured from the hills on his farm, Hartebeestpoort, 498, Pretoria District. He thinks the deposit, which is about six inches thick, is about seventy or eighty years' old, and it occurs on the site of an old cattle kraal built by the natives. The deposit is thus similar in origin to that described in this Journal, Vol. II., p. 417, as occurring near Steenbokfontein, Rustenburg.

On analysis the following figures were obtained :—

Moisture	5.93
*Loss on ignition	19.59
Insoluble matter (sand, etc.)	67.28
Iron oxide and alumina	4.87
Lime	0.62
Magnesia	0.13
Potash	0.22
Phosphoric acid	0.98
	99.62
*Containing nitrogen	0.71

The substance, therefore, more nearly approaches a soil than a manure in composition and could not pay for transport to any distance. If, however, the labour involved in conveying it to the land be not too expensive, it would be of some value, locally, as a source of nitrogen and phosphoric acid. Needless to say, it would require to be applied in large quantities—several tons to the acre—to have any useful effect.

Animal Ash.

The carcasses of animals dead of disease or under experiment at the Veterinary Bacteriological Station at Daspoort are incinerated and the ash left is possessed of considerable value as a manure. A sample gave the following figures on analysis :—

Moisture	1.39
*Loss on ignition	13.09
Insoluble matter	13.78
Iron oxide	5.17
Lime	35.23
Magnesia	0.66

Phosphoric acid	28.16
Potash	1.48
Undetermined (soda, chlorine, etc.) ..	1.04
	100.00
*Containing nitrogen	1.27
Containing carbon dioxide..	1.97

The valuable manurial constituents are :—

Phosphate of lime	61.48
Potash	1.48
Nitrogen	1.27

Evidently, from the "loss on ignition" and nitrogen present, the product was not completely burnt. It is a valuable manure when finely crushed, and, compared with the price of artificial manures at the coast, is worth about £7 9s. per ton of 2,000 lbs.

SUGAR BEETS.

Several samples have been examined for their sugar content. The following gives the percentage by weight of sugar present in the samples as examined :—

No. 1 (variety unknown)	17.74
No. 2 (Klein Wangleben)	17.87
No. 3 (Vilmorin White)	14.90
No. 4 (White French)	15.01

Sample No. 1 were somewhat withered and dried. The ro ts were very small, averaging about 1 lb. each and were badly shaped, indicating that they had been grown on land not deeply cultivated. Probably the sugar content of the freshly dug roots would be lower than that found in the partially dried sample. Samples 2, 3 and 4 were grown without irrigation on the Experimental Farm, Potchefstroom, and were examined while still fresh and firm.

MARULA NUTS.

A specimen of the kernels of the fruit of the Meroola or Marula (Sclerocarya Caffra) tree was received some time ago from Mr. H. A. Baily. The fruit was grown near Thabena in the Zoutpansberg. An analysis gave the following figures :—

Moisture	4.05
Ash	3.82
Oil	48.72
Protein	28.31
Carbohydrates and fibre ..	15.10
	100.00

A small quantity of the oil was extracted and has been examined by Dr. Harry Ingle, of Kirkcaldy, N.B., who reports as follows :—

"The oil should be very useful for lubricating purposes, being about mid-way in viscosity between olive and rape oil. I think it

might be used as a substitute for olive oil in cloth manufacture. It gave the following constants :—

Iodine value (Wijs)	74.0
Acid value	21.0
Saponification value	200.0
Viscosity (olive oil = 31) ..	36.0
Specific gravity (at 15° C.) ..	0.9179

As to the value of the oil—olive oil is quoted at £30 to £33 10s. per ton, rape from £28 to £29 10s. per ton in Liverpool. The oil from marula ought to fetch about these prices."

If the kernels could be procured in quantity, it would appear possible to initiate a trade in this oil-bearing material.

* * * *

ABSTRACTS.

The Fixation of Atmospheric Nitrogen by Electro-Chemical Means.

Though this subject was alluded to in a short article in the April number of this Journal,* it is of such economic importance and interest that an abstract of an important paper read before the London Section of the Society of Chemical Industry by Prof. P. A. Guye on May 21st, 1906, may, perhaps, be acceptable to some of our readers. ("Journal of Society of Chemical Industry," June 30th, 1906, 567.) The author commences by emphasising the importance of the problem.

The two principal sources of combined nitrogen for agricultural and other purposes are Nitrate of Soda from Chili, Peru and Bolivia, and the Sulphate of Ammonia obtained by the distillation of coal.

In 1905, the entire consumption of nitrate of soda was 1,567,000 tons, of which about 300,000 were used in chemical industries, while the remainder, 1,267,000 tons, was employed for manurial purposes. The consumption for agricultural purposes is increasing, and recent calculations indicate that, at the present rate of increase, the Chili beds will be exhausted about the year 1923.

The figures for ammonium sulphate are not quite so reliable, but the entire world's production for the year 1905 is estimated at between 500,000 and 600,000 tons. Of this quantity all but 10 or 15 per cent. is consumed as manure. In England the market prices during 1905 have been :—

	Per ton.			Per kilogramme of Nitrogen.	
	£	s.	d.	s.	d.
Nitrate of soda (16.5% N.) ..	10	7	6	1	3
Sulphate of ammonia (21.2% N.)	12	10	0	1	2½

* Page 588.

Of the many proposed methods for the electro-chemical fixation of nitrogen, two only have received industrial application, viz. :—

I.—The production of calcium cyanamide—" kalkstickstoff " ;

II.—The manufacture of nitric acid and nitrates.

I.—*Calcium Cyanamide.*

As already described in this Journal (Vol. III., pp. 527 and 535), the first step is the production of calcium carbide by the action of an electric furnace upon a mixture of coke and lime.†—

$$CaO + 3C = CaC_2 + CO.$$

The second step is strongly heating calcium carbide in a current of nitrogen (from the air)

$$CaC_2 + N_2 = CaCN_2 + C.$$

The calcium cyanamide thus formed is capable, when acted upon by water, of yielding ammonia—

$$CaCN_2 + 3H_2O = CaCO_3 + 2NH_3.$$

This reaction goes on slowly in the soil.

The mass of cyanamide obtained (black from admixed carbon) usually contains from 14 to 20 per cent of nitrogen instead of the theoretical 30 per cent. in the pure product.

As to cost—if the cost of production of calcium carbide be taken at £5 11s. per ton, which can only be realised under the most favourable conditions as to water power for production of electricity, etc.,—the cost of production of calcium cyanamide containing 20% of nitrogen is estimated at £10 14s. per ton, which is equal to 1s. 2d. per kilogramme of nitrogen. With the average cost of production of carbide in Europe of £7 6s. 7½d. per ton, calcium cyanamide would cost about £12 11s. 3d. per ton, or 1s. 3½d. per kilogramme of combined nitrogen. The price of the combined nitrogen in calcium cyanamide would thus approximate to that of the nitrogen in sulphate of ammonia or nitrate of soda.

But its efficiency as a manure is not so great. Exact determinations have not been made ; indeed, it seems to vary with circumstances. Taking nitrogen in Chili nitrate as 1, the manurial value of nitrogen as calcium cyanamide has been found to be between 0.64 and 0.95. Taking 0.85 as the average, it appears that, with carbide at £12 11s. 3d. per ton, available nitrogen is more expensive in the cyanamide than in sulphate of ammonia.

II.—*Nitric Acid and Nitrates.*

When electric sparks pass through air, combination of nitrogen and oxygen slowly occurs, and, in presence of moisture, nitric acid is eventually formed. This has been known since the days of Priestley and Cavendish (1784). Recently, attempts to utilise this on the large scale for the manufacture of nitrates have been made and with some success.

† 1 kilowat year of electric energy will, under good conditions, yield 2·1 tons of calcium carbide containing 80 per cent. of the real substance, i.e., one horse power working for a year would produce 1·575 tons (3,528 lb.) of carbide.

The main considerations are (1) to obtain as high a temperature in the electric arc as possible, and (2) to cool the gases as quickly as possible after combination has occurred. This is because the first product of the union, nitric oxide, N O, splits up at a slightly lower temperature into its constituents, and, by hastening the cooling, this reversal of the fundamental reaction is checked. In any case, so far, the air which has been acted upon by the arc contains only about 1 or 2 per cent of nitric oxide, the rest being unchanged oxygen and nitrogen. As the mixture cools, the nitric oxide combines with some of the free oxygen to form red nitrous fumes (nitrogen peroxide, $N\ O_2$), which, on being led into water, gives a mixture of nitrous and nitric acid, or, if led into caustic soda or lime, yields a mixture of nitrites and nitrates.

In Norway, the process is worked on a large scale, the output being so far entirely in the form of a basic nitrate of lime containing about 75 per cent. of real calcium nitrate and some free lime. It thus contains about 13 per cent. of nitrogen.

The yield of nitric acid from a given amount of electrical energy supplied to the furnaces varies greatly. Thus, at the Notodden works in Norway, the highest yield recorded gives 900 kilogrammes real nitric acid per kilowatt year,* but the average was not more than 500 or 600 kilogrammes per kilowatt year.

Elaborate estimates as to cost of production including all details are given, the final result being that the cost of production of nitrate of lime would correspond to about 1s. (one shilling) per kilogramme of combined nitrogen, *i.e.*, would be lower than its cost in Chili nitrate of soda.

To summarise the statistics as to prices in England or at the works of one kilogramme of combined nitrogen (2.205 English pounds) in the various forms suitable for manurial purposes—

	s.	d.
In Chili nitrate of soda (at £10 7s. 6d. per ton) ..	1	3
In sulphate of ammonia (at £12 10s. per ton) ..	1	2½
In calcium cyanamide (electrical) .. 1s. 2d. to	1	3½
In calcium nitrate (electrical)..	1	0

A long and interesting discussion, in which many of the leading Industrial, Electrical and Agricultural Chemists took part, followed the reading of the paper.

At present, the process can only be economically worked where the electric energy is provided by water power. If steam or gas engines were used, the cost would be much higher. In this Colony, therefore, there is not much prospect of works for the production of these products being started, though there is the possibility that, in neighbouring Colonies—Rhodesia at the Victoria Falls and Natal at the Howick falls—one or other of the industries might be successful. —H. I.

* That is, one horse power, employed continuously for a year would, under the best conditions yet realised produce 675 kilogrammes (1,485 lb.) of nitric acid.

REVIEW.

"SUNRISE, MOISTURE AND GROWTH," BY COLONEL H. E. RAWSON, C.B.

In view of the interest which has been excited by the appearance of Colonel Rawson's papers in the April and July numbers of the "Journal," and by a lecture which was delivered in Pretoria on September 1st, we have been led to believe that a short description of the relationships between light and temperature on the one hand and plant growth on the other, may perhaps be acceptable to our readers.

At the same time we trust that the following account may serve to dispel some of the apparent mystery which is thought to surround Colonel Rawson's results and remove the necessity of attributing any occult influence to the sunrise rays.

The germination of a seed is determined almost entirely by the following conditions :—

1. Suitable temperature.
2. Sufficient moisture.
3. Access of atmospheric oxygen.
4. Removal of the evolved carbon dioxide.

Access of light (of the sun or other source) has no favouring influence on germination in the case of most seeds, the most powerful factor being that of temperature. For each variety of seed it is possible to experimentally determine the minimum, optimum and maximum temperatures at which germination occurs.

Thus, the following table gives these three points in degrees Fahrenheit for several plants :—

	Minimum.	Optimum	Maximum.
Wheat	41°	89°	108°
Barley	41	89	104
Maize	49	93	115
Peas	44	89	102
Pumpkins	56	93	115

Certain low forms of vegetation have limits much higher and lower than the examples given. Some bacteria are known in which the optimum temperature is about 158° F. and the maximum 167° or even higher, while, on the other hand, algæ will grow in sea water at a temperature of 32° F. or lower.

Moreover, since seeds are usually covered with soil, sunlight can have no effect upon them beyond the heating effect.

If, therefore, the presence or absence of the rays of the morning sun had such effects on the germination of peas as are described in the papers referred to (and we greatly doubt that the failure of some of the peas to germinate had any connection with sunlight) it must have been through a temperature effect.

The influence of temperature, too, is very potent in affecting the rate of growth of seedlings. This is well seen from the following table which gives the lengths in millimetres (25.4 m.m. = 1 inch) attained by seedlings after being kept for 48 hours at the various temperatures :—

Temperature.	Lupins.	Peas.	Beans.	Maize.	Wheat.
58° F.	9.1	5.0	—	—	4.5
62.5°	11.0	5.3	—	—	6.9
70.5°	25.0	25.5	9.3	3.0	41.8
76°	31.0	30.0	10.1	10.8	59.1
72.2°	40.0	27.8	11.2	18.5	59.2
80°	**54.1**	**53.9**	**21.5**	29.6	86.0
83.2°	50.1	40.4	15.3	26.5	73.4
86.5°	43.8	38.5	5.6	**64.6**	**104.9**
92.3°	12.9	8.0	—	50.2	40.3
97.7	12.6	8.7	—	20.7	5.4
103°	6.1	—	—	11.2	—

It will be seen that the rate of growth increases rapidly with a rise of temperature especially just below the optimum, and that, with a further rise of temperature, falls off rapidly. For peas, we may take 50° as the minimum at which growth is appreciable, 80° F. as the temperature of the greatest growth, and 100° F. as the maximum.

Colonel Rawson appears to be unwilling to admit that there can be much difference in temperature between a plant receiving the direct rays of the morning sun and a neighbouring plant only a few feet away but screened from the sun.

It is true that the *air* temperature in the two cases would be practically the same, but a plant or the surface soil receiving the direct sunshine may be heated to a far higher temperature than that of the surrounding air.

In some cases this elevation has been observed to amount to 40° or 50° F., especially in the case of thick, fleshy-leaved plants or dark coloured soils. This too, in spite of the cooling effect of the evaporation of water from the stomata of the leaves, which, in the dry atmosphere prevailing here must often be very rapid. Experiments conducted by one of us show that the amount of water exhaled by a potato plant for each gramme of dry matter formed is much greater in this Colony than in Europe..

In the same way, on clear nights, plants and the surface soil are often cooled by radiation to a temperature far below that of the surrounding air.

In Colonel Rawson's papers he states that the mean maximum temperature during his experiments was 77° F., the mean minimum 52°. We may safely conclude that the plants themselves were

subjected to far greater variation. Thus, at night, the temperature of the peas would probably be too low to permit of much, if any growth, since, as shown by the table, this is very small even at 58° F., while in the hot part of the day the actual temperature of the plants was probably too high to allow of any growth, which, as the table shows, ceases about 100° F. The periods of active growth would, therefore, be restricted to the transition between the too low night and too high day temperatures. It is, therefore, obvious that any circumstance which would shorten the period of transition would materially retard the growth.

Such would be the effect of shutting off the early morning sunshine.

The plants shaded from the rays of the rising sun would remain below the optimum temperature until much later than those receiving those rays, and when they did receive the direct rays, the sun would have attained a greater height and, therefore, more heating power. The plants would thus quickly pass through the optimum temperature and soon be raised to a condition where growth would be slow or utterly cease.

Thus the periods of active growth would be shorter than those of their unshaded neighbours, apart altogether from their being deprived for an hour or two each morning of the benefit of the direct photosynthetical rays of the sun, so important to the work of carbon assimilation. The importance of prolonging the duration of the period during which the plants are between the minimum and maximum temperatures of growth is of especial importance in this country where the extremes of temperature between night and day are so great. In England and other countries of moderate climate, the importance of the rays at sunrise and sunset is not so marked, as it is comparatively rarely, even at mid-day, that the optimum temperature is exceeded. In this Colony it is probably exceeded every day, and, in many instances, even the maximum temperature at which growth occurs for many plants must be reached and passed.

Consequently, the advantage to plants. in receiving the rays of the rising sun and thereby being warmed gradually, must be considerable.

In this connection, too, we may point out that the great difficulty under which plants labour in our Transvaal winter, lies not so much in the extremes of temperature to which they are exposed, as in the rapid alternations of these extremes. It is not so much the severity of the frost at night which destroys vegetation (even when well watered) as the fact that the frosts only last for a short time and are preceded and followed by a very high temperature in the middle of the day. Plants thus have difficulty in adjusting themselves to these rapid alternations of temperature, and any circumstance, such as shutting off the early morning sun, which tends to increase the rapidity

of the gradation from one extreme to the other, renders this adjustment more difficult and is injurious to the plant.

The statements just made are true and can hardly be doubted, but it occurred to us that direct measurements of the amounts of the differences in temperature between objects receiving the direct sunrise rays and those otherwise similarly circumstanced, but shaded from the sunshine, would appeal perhaps more forcibly.

One of us accordingly carried out several experiments in a garden in Arcadia, Pretoria, on September 5th, 6th and 9th. Before sunrise, a small screen of wood (made double with an air space between so as to prevent any passage of heat by conduction), about 10 inches high and 16½ inches long, was placed on an open lawn in a direction running north to south. A thermometer was placed on the ground to the west of the screen with the bulb at a distance of 6½ inches from the screen. A similar thermometer rested on the open lawn about a foot to the north of the screen.

On September 5th, readings of the two thermometers were taken every 15 minutes, beginning at 6 a.m. At 6.23 the edge of the sun's disc appeared above the skyline to the east, and, by 6.26 the whole of the disc was visible. The morning was somewhat cloudy with a high wind and there was no dew (an indication of a cloudy night), conditions which would tend to make the heating effect of the sunrise rays much less than on an average bright, calm morning. The results were as follows :—

a.m.	Thermometer in open.	Thermometer in shade of screen.
6.0	11.8° C.	11.7°C.
6.15	11.9	11.4
Sunrise.	Sunrise.	Sunrise.
6.30	11.4	11.2
6.45	11.9	11.4
7.0	13.2	12.0
7.15	13.8	12.8
7.30	16.2	13.4
7.45	16.9	13.8
8.0	19.2	14.6
8.15	20.0	15.4
8.30	22.2	16.2
8.45	23.2	16.8

At the same time two other thermometers, with the bulbs at a depth of about 1 inch in the soil, were also read—one being in the open, the other screened from the sunrise rays. As a fuller series of observations were taken later, the figures need not be given in detail, but at 8.45 the screened thermomter had risen 1.9° C., while the one receiving direct sunlight had risen 5.1° C.

The direct heating effect of the morning sunshine upon bodies actually exposed to its radiation was thus considerable, notwithstanding

the fact that there was a wind blowing, which would tend to equalise temperature, and that the sun was several times partially obscured by clouds.

On September 6th the early morning was bright, clear, calm and cold. There was a heavy dew. The sun rose above the skyline at 6 hr. 23′ 50″, and was fully up at 6 hr. 26′ 10″. The results of the thermometer readings were as follows:—

	Unscreened.		Screened.	
Time	On the Ground.	In the Soil	On the Ground.	In the Soil.
6.0	7.2° F.	10.6° F.	7.4	10.9
6.15	6.2	10.2	6.8	10.9
6.30	6.0	10.2	6.7	10.9
6.45	7.1	10.2	7.2	10.9
7.0	8.1	10.8	7.7	11.0
7.15	11.0	11.8	8.0	11.5
7.30	13.0	12.8	10.2	11.7
7.45	14.9	14.0	10.8	12.0
8.0	16.1	14.8	11.5	12.5
8.15	18.0	16.0	12.4	12.7
8.30	19.6	17.0	13.3	13.1
8.45	21.0	18.0	14.1	13.7
9.0	22.8	19.1	14.9	14.0
9.15	25.1	20.5	15.5	14.5

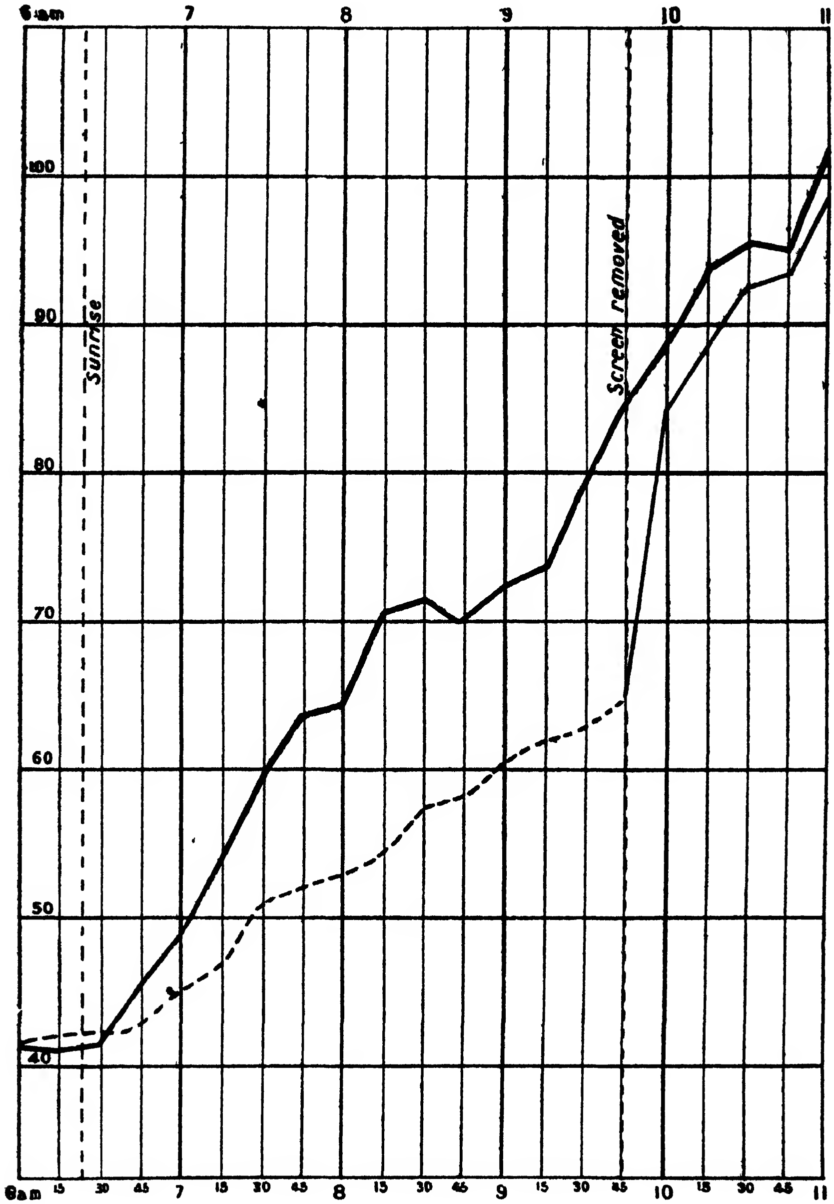
Thus, while in 2¼ hours from 6.30 a.m. the unshaded thermometer rose through 19.1° C., a similar thermometer screened from the direct sunshine only rose through 8.1° C. Meanwhile, at a depth of about 1½ inches the temperature of the soil rose 10.3° C. where it received sunshine, and only 3.6° C. where it was in shade.

A difference of 11.0° C. (20° F.) in the temperature of a plant, or of 6.7° C. (12° F), is sufficient to have a considerable effect upon the rate of growth, for, according to the table already given, the rates at the final temperatures, 25.1° C. (77.2° F.) and 15.5° C. (60° F.) are, in the case of the pea, in the ratio of more than 5 to 1. It is true that this advantage of the unshaded plant would not be so great soon after sunrise, but a glance at the temperatures will show that after 7.0 a.m. the plants in the direct sunlight would be at a constantly increasing advantage as to temperature.

On September 9th a longer series of observations was made, and the rise of temperature following the removal of the screen was also recorded.

In Fig. 1 the results are recorded graphically for the thermometers placed on the ground. The continuous black line gives the temperatures in the sun, the dotted line those of the thermometer whose bulb was shaded by a screen from before sunrise (6.20 a.m.) until 9.45 a.m.

FIG. 1



We may assume that with a pea plant no growth would occur below 50° nor above 100°, and that the growth would be much more rapid from about 70° to 85° than at any other temperature.

It will be seen that a plant receiving direct sunshine would reach 50° shortly after 7.0 a.m., and would attain 70° F. about 8.15 a.m.,

85° F. about 9.45, while a shaded plant would attain 50° about 7.30, but would not reach 70° until after 9.45, when the screen was removed.

Thus an unshaded plant would probably be between 70° and 85°—the most favourable temperature for growth—from 8.15 to 9.45, while the shaded ones would only possess this temperature for a few minutes between 9.50 and 10.10. The advantage to the unscreened plants is thus evident and is the more important, since after about 11.0 o'clock the temperature rose so high as to inhibit growth.

We realise that the thermometer readings are not necessarily identical with the temperatures attained by the leaves of the plant, but they undoubtedly are a measure of such temperatures.

The fluctuations in the curve for the unscreened thermometer between 8 and 9 o'clock were due to the effects of clouds, which about that time, partly obscured the sun. The morning, indeed, was not favourable for the observations, as many clouds were about.

FIG 2

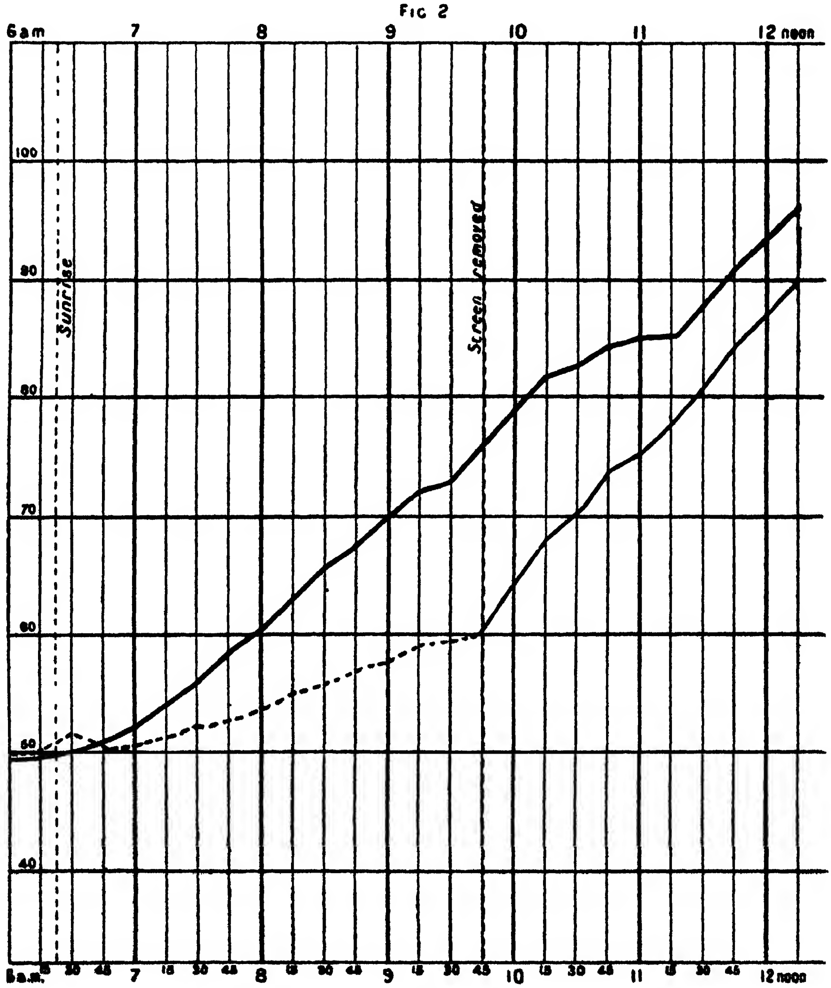


Fig. 2 shows the results obtained with two thermometers immersed in the soil so that the centres of their bulbs were one inch below the surface. As before, the continuous line gives the readings of the thermometer in the unshaded soil, the dotted line those of the instrument in the soil screened until 9.45 from the direct rays.

The results show, in a similar manner, the effect of sunrise rays upon the rise of temperature, and indicate the advantage possessed by the roots of plants in soil receiving those direct rays.

That many plants show a marked periodicity of growth under normal conditions is well known. The rate of growth is usually at a maximum between 6 a.m. and 9 a.m. It then diminishes rapidly during the day until about 5.30 p.m., after which it rises again and attains another maximum the next morning. These results refer to growth in length of stem and not at all to increase in weight. But the variations are intimately connected with changes of temperature and are probably induced by this influence.

While we are of opinion that by far the most potent influence of the morning sun is exerted by its effect upon temperature, we would not deny that other effects may have some share in producing the results.

Sunlight consists, as is well known, of ether vibrations of various frequencies—the slower ones affecting the eye with the sensation of red, the rapid ones with blue or violet impressions.

By means of a prism or prisms, a ray of light can be split up into its constituents and gives the band of colour known as a spectrum, each particular kind of vibration being bent out of its original path to an extent dependent upon its wave length. Thus the short violet rays are more bent than the blue, the blue than the green, the green than the yellow, the yellow than the orange, and the orange than the red. It has been shown experimentally that while the yellow and orange rays possess in the highest degree the power of enabling the chlorophyll corpuscles of plants to absorb and assimilate carbon dioxide, it is the blue, violet and ultra-violet (*i.e.*, the rays or shorter wave length than the violet, and to which the eye is not sensitive) rays which exert the greatest influence upon growth and movement of plants.

Now, there is no reason to believe that the character of the radiations emitted from the sun are subject to any diurnal variation, and it is therefore obvious that any peculiarity in the nature of early sunrise rays received on the surface of the earth must be due to modifications induced by the passage of the light through the earth's atmosphere.

At sunrise and sunset the sun's rays have to traverse a much thicker layer of the atmosphere than at noon, and consequently any absorptive effect is more pronounced.

The chief absorptive effect is due to the aqueous vapour in the air, and it is known by common experience that sunlight in the early

morning and late evening is relatively less rich in the more refrangible rays (violet, blue, etc.) than during the day.

Thus it is probable that sunrise light contains a sufficiency of orange and yellow rays to produce rapid carbon assimilation, while the blue and violet rays, which tend to reduce growth, are relatively deficient.

The unscreened plants, receiving such rays at a period when their temperature is favourable for the performance of their vital functions, thus have an advantage over their screened neigbours, which do not receive such strong light until later in the day, when their temperature is quickly raised to a point not so favourable for assimilation but more favourable to the respiratory processes, by which their tissues are oxidised and diminished.

One important conclusion may be deduced from the considerations discussed in this review—that many plants would be benefited by being shaded from the hot midday sun, thus often preventing them from being heated above their maximum temperature for growth. That this practice is useful is proved in the case of tobacco by the gigantic scale on which this crop is grown under canvas awnings or screens in certain parts of the United States. It would thus seem that our abundance of sunshine, which we are apt to consider so valuable an aid to the growth of vegetation in this Colony is, in the case of many plants, in excess of their requirements, and that, unlike England, the Transvaal would be more productive if we had less of it.

In conclusion, we desire to express our thorough appreciation of Colonel Rawson's work, and while we have ventured to differ with some of his deductions, inasmuch as we are of opinion that his results may be explained by the effects of temperature changes, and without attributing any occult influence to the morning sunshine *per se*, we think that his papers have raised points worthy of careful attention at the hands of those interested in gardening under the climatic conditions which obtain in this sunny land.

HERBERT INGLE and I. B. POLE EVANS.

THE BOTANICAL SECTION.

No. 1.]

CHICORY GROWING.

By Joseph Burtt-Davy, F.L.S.,
Government Agrostologist and Botanist.

On account of the demand for chicory-root (*Cichorium intybus*), we have received enquiries as to the possibility of growing it in the Transvaal. The Transvaal imports of chicory for the three months ending March 31st, 1906, were 77,250 lbs., valued at £700, while last year Cape Colony imported 1,052,145 lbs.

The chief use of chicory-root is for mixing with coffee. Many persons who are accustomed to it prefer a mixture of chicory-root and coffee to pure coffee; it appears to have no injurious effect on the human system. Chicory is also used medicinally, and, to a limited extent perhaps, in the preparation of porter and snuff. In Europe chicory is sometimes grown as a pasture and forage crop, particularly on dry lands, for, being deep-rooted, it is able to withstand drought better than the European pasture grasses. The leaves should not be fed to milch cows, as they are apt to make the milk bitter.

Present supplies of chicory-root are obtained from Northern Europe. The United States and Great Britain produce little more than enough for their own use. Although chicory can be and has been grown successfully in Cape Colony (in the Paarl Division, Alexandria, Queenstown and East London, but especially round King Williamstown), none appears to be grown commercially at the present time, although "there is not only a market waiting, but also manufacturers ready and willing to take it if they can obtain a steady supply in sufficient quantity." If the crop is a profitable one, it is somewhat surprising that Cape Colony farmers do not cultivate it, when the local demand exceeds a million pounds weight, valued at over £8,750, and when it is protected by an import duty of 2d. per lb. The reason for this anomaly is not quite clear, and Transvaal farmers would do well to look into it before embarking on the industry. It should also be borne in mind that to grow chicory-root successfully and profitably, careful attention and considerable labour are required. It is by no means a lazy man's crop. Chicory does not appear to have been grown commercially in the Transvaal, but experiments at Skinner's Court show that good roots can be grown even with a light rainfall such as we had last year.

Soils.—Although chicory will grow upon most kinds of soil, the selection of the most suitable soil is of the greatest importance where the development of good, marketable roots is desired. It prefers a

soil containing lime, and will grow on somewhat "brak" lands. Care should be taken to select a loose, light loam, free from stones, which make the roots uneven and unshapely. It is particularly desirable that the sub-soil be loose and friable; the presence of hard-pan, ouklip, or similarly impermeable layers near the surface prevents the full downward development of the long tap-root. Heavy clay soils and black turf soils which become hard in dry weather are also apt to produce badly-shaped and dirty roots, and make it more difficult and expensive to lift the crop. Manufacturers deduct about 5 % for dirty roots. The black "turf" soils are also apt to "lift" in dry weather, causing the seedlings to die off before they can become well rooted; sandy soils, on the other hand, are apt to be too dry. Soils too rich in nitrogenous matter may produce too much leaf and top, at the expense of the root. The land should not have stagnant water near the surface.

When the question of suitable soil has been satisfactorily settled, the question of situation must be considered; whether a bult should be chosen, or whether bottom land is preferable, will depend, after the soil texture, on the moisture present, at least if irrigation is out of the question. Soils too wet for ordinary farm crops are also too wet for chicory, hindering early growth and preventing proper "ripening" of the roots. On the other hand, although it is true that soils too dry to produce some farm crops without irrigation may raise a crop of chicory, it is also true that soils may be too dry to produce good, marketable roots.

On the prairie lands of the Western United States, it has been found that newly broken veld is unsuited to chicory culture, and though we cannot yet say that this is the case here, this point should be borne in mind.

Irrigation.—Chicory may be grown either as a dry land crop or under irrigation, but the yield may often be increased from 50 to 100% with the application of water.

Manures.—On very poor soils, kraal or stable manure may be used with advantage, but it is often too rich in nitrogen and too poor in potash and phosphoric acid; the latter plant foods are of great importance to this crop. Artificial manures containing these fertilizers will probably be found advantageous where they are lacking in the soil, but before using them it would be advisable to have an analysis made of the soil on which it is proposed to grow the crop, in order to determine what is lacking. If stable manure is to be used, it should preferably be applied to the crop preceding the chicory.

It is not profitable to grow chicory on the same ground indefinitely; the yield and quality are sure to suffer. It would, therefore, be desirable to grow this crop in rotation with others, such as mealies, velvet beans, cowpeas, or soy beans; the beans or peas should precede the mealie crop.

Preparation and Cultivation of Soil.—To produce good roots, *deep* ploughing and cultivation of the soil are essential; ploughing and sub-soiling to the depth of at least ten inches should be done in the

autumn, after the mealie or mangel crop has been harvested, the land being left rough and open for winter fallow. In the spring it should be thoroughly harrowed, and deeply cultivated to get the soil into good loose condition to allow of the fullest possible development of the roots.

Seed Sowing.—The seed should not be sown until the soil has been brought into the best possible condition, and the weather is favourable; probably September or October will be the most suitable time for the high veld, where the ground can be irrigated thoroughly; if the rains come late, it may not be safe to sow before November. As an irrigated winter crop in the middle veld, sowings at the end of February or in March may be satisfactory in some districts, but this must be determined for each locality by local experiment; if sown too early, the plants are apt to throw up more flower stems, and the roots of such plants are worthless from the manufacturer's point of view. Seed should be sown in drills 12 to 15 or 18 inches apart, according to circumstances, and the seedlings should be thinned out, by degrees, to 4, 8 or 10 inches in the row. A "Planet Junior," or other hand drill which will not clog, may be used, and about 1½ to 2 lbs. of seed per acre will be required.

Only the best seed should be used; preferably that which has been grown especially for root production. It should give a germination of about 85% and purity of 90%. In Europe it is customary for the factories to supply the seed to the growers, and this seed is generally superior to that obtainable in the open market.

There are several varieties in cultivation, some of which give better roots than others. The "Brunswick" and "Magdeburg" varieties are largely grown for the roots, and a cross between the Brunswick and Silesian is said to have been particularly successful in Cape Colony. The "Magdeburg" is longer in the root, and is said to be rather harder to lift, than the "Brunswick." The "Elite" is also recommended by American growers.

After-Cultivation should be practised, both to keep the crop free from weeds and to keep the surface soil loose. For this work the hand hoe is generally preferred, as it allows the rows to be sown to 12 inches, and permits of more thorough and uniform cultivation; the hoeing should be quite shallow, only deep enough to kill the weed seedlings and loosen the surface; deep hoeing is prejudicial to the formation of good roots. When the plants are an inch or so high they should be thinned to 4 inches, and finally 8 or 10 inches, in the row according to growth; no two plants should be left to grow side by side, as the two roots so grown are generally smaller and less valuable than one would be if grown singly. The general treatment is much the same as for carrots, but the crop requires less water. At least two cultivations after thinning are desirable, after which it will be necessary to remove any large weeds and such chicory plants as have gone to flower.

Harvesting, Market, etc.—Chicory requires from 5 to 6 months to ripen under favourable conditions. The Editor of the Cape

"Agricultural Journal" writes that it is ready for lifting "when the lower leaves are turning yellow, and when the root breaks across with a short fracture and is full of milky juice, not dry and fibrous, in which case the chicory is gritty and tasteless. . . . . . Lift the roots in dry weather so as to keep them clean; cut the tops off, but not so low that they will bleed. A common mistake is to dry the roots too early or too late, and in either case chicory of much diminished value results."

The yield ranges from 3 to 10 tons per acre on dry lands, and up to 15 tons with irrigation and particularly good cultivation.

In Cape Colony, good, ripe, fresh roots may bring up to £2 10s. per ton at the factory. One factory alone is able to deal with 150,000 lbs. weight of fresh root per week.

The Editor of the Cape "Agricultural Journal" wisely observes that "chicory must not be regarded as a crop from which fortunes are suddenly to be made; but it is certainly worth cultivating along with others, where conditions are suitable. Where chicory is found by experiment or previous experience to answer, it is of the utmost importance to farmer and manufacturer alike, to arrange and ensure that a regular supply may be forthcoming. Without this the industry of chicory drying and grinding is hopeless and impossible, as witness the fact that factories have for months past been idle, and, unless special inducements offer and a regular and considerable supply can be guaranteed, will not commence work. . . . Prospective growers would, therefore, do well to come to some arrangement with manufacturers previous to embarking upon the cultivation of chicory, and it would seem particularly desirable that a number combine, so as to furnish the necessary amount and to distribute the supply over a longer time."

* * * *

No. 2.]

LUCERNE CULTIVATION.

When once it is properly established, there is no question that lucerne is one of the most useful and profitable crops that can be grown in the Transvaal.

As an irrigated crop there is no longer any question as to its success, but on dry lands lucerne is still only in the experimental stage as regards locality and soil, the past two seasons having been too dry to allow the stands to become thoroughly established. There is no doubt that in suitable situations, such as we have chosen at Skinner's Court, excellent stands of dry land lucerne can be secured. Most encouraging reports have also been received this winter from farmers who have been carrying on co-operative experiments with us, and most of them are now satisfied that dry land lucerne is going to be a valuable addition to their pasturage, especially in early spring and late autumn. Much depends, of course, on soil, locality and season of

sowing; failure to catch a good rain shortly after sowing may result in complete failure of the crop. On the hot sandy soils and light-grey loam soils of the middle veld east of the Drakensberg, and in parts of the Waterberg District, it was found, last season, very difficult to get good stands, though even there some farmers were successful, having "caught the season" favourably.

To establish a good stand of lucerne is not always easy. Until the seedlings have had time to push their roots deep into the soil, they are liable to die off in hot weather, or to be choked by weeds, or cut off below the surface of the soil by cut-worms, or on top by the lucerne caterpillar.

At Skinner's Court, on dry land, lucerne has given five cuts the second year in addition to some grazing. No return should be expected the first year; it usually takes three years for a stand to come to its full bearing. As an irrigated crop as much as ten cuts a year have been obtained in the Transvaal; that is to say, one cut a month from August to May inclusive.

Lucerne is a crop which, when well established under thoroughly favourable conditions, has been known to give good returns for fifty or even sixty years in succession. As the crop is, therefore, a permanent one and the yield per acre heavy, and as it is one of the most valuable crops in this country, it is evident that it will pay to take particular pains in preparing the soil and obtaining a good stand.

Method of Sowing.—The best method is to drill the seed, as the crop can then be better cultivated and kept clean, with a correspondingly heavier yield. Cultivation between the rows tends to conserve the soil moisture; it further allows rain to sink into the soil which would otherwise run off the hard surface. Lucerne responds well to cultivation, and a "Martin" or "Ducksfoot" cultivator will be found a handy machine for this purpose; a horse hoe may also be used between the rows for cleaning purposes. Drills may be 9 to 12 or 15 inches apart, according to circumstances; on irrigated lands in Cape Colony the drills are sometimes set 18 inches to 2 feet apart, but in the Transvaal this appears to be unnecessarily wide, resulting in a waste of ground. We have used a "Reed-Säck" with good success.

Soil.—Old lands should be avoided for a seed bed, unless they have carried a cleaning crop the previous year, *i.e.*, a hoed crop, such as potatoes or mangles; or unless weeds have been destroyed by ploughing under. New land is therefore often preferable for laying down a stand. The danger of the weeds arises from the fact that they grow faster than the young lucerne—before it gets its roots well down—and once having got ahead they check the growth of the seedlings and a stand rarely recovers its full vigour. The view is held by many farmers that lucerne will choke out weeds, but it has been repeatedly proved that this idea is erroneous; the surest way to ruin a good stand of lucerne is to allow it to become weed-ridden. On this account, too, the use of fresh stable or kraal manure should be avoided, at least until the stand is well established. A good dressing of bone meal might be beneficial if drilled in with the seed.

Those soils which "lift" on drying out after a shower are unsuited to lucerne culture, as the surface soil becomes open and the roots dry out. Much of the black turf soil is inclined to lift in this way. Vlei soil, where the water table rises to near the surface in summer time, that is to say within five feet of the surface layer of soil, is also unsuited, as the deep roots of the lucerne may become rotted and the crop then dies off. Stony or shaley soils, and bults with shallow soil, are also unsuitable.

The exact localities and soils which will be suited to dry land lucerne can only be determined by experiment, but it may be expected to grow on most parts of the high veld, and probably on the *lower slopes* of bults, rather than either on the ridges or at the bottoms of hollows; exceptions may be found to almost every rule, however.

Only deep soils should be chosen. Thorough and deep cultivation are necessary before sowing; the advantage of a well prepared and fine seed bed cannot be overrated. The ground should have an even grade; if uneven the ridges and hillocks will dry out first before the hollows, and an uneven crop will result.

Sunburn.—The seedlings are very sensitive for the first few days after they appear above ground, and it is therefore advisable to sow, as far as possible, at such a time that germination and first growth will take place during cloudy weather.

Use of a Nurse Crop.—This is a point on which there is considerable difference of opinion. At present we are not prepared to recommend any suitable crop as a nurse crop; for the tendency is for the nurse plant to take too much moisture from the soil between the intervals of rain storms, thereby depriving the lucerne seedlings of necessary moisture. A further danger is that weed seeds will be sown with the nurse crop, especially if oats are used.

Buckwheat is said by some farmers to have proved one of the most promising crops for this purpose, but we cannot yet speak authoritatively on the point as we have not seen any good stand obtained in this way. Rape seems unsuitable, as it sometimes germinates much more slowly than the lucerne.

In the case of irrigated lucerne we have seen some fair stands obtained with oats as a nurse crop, but where sufficient water is available no nurse crop is really required, unless to give a little crop by way of return, before the lucerne is ready to cut.

Time of Sowing.—In the Witwatersrand, Pretoria and Waterberg districts, the best months for sowing on dry land seem to be January and February, and this, speaking generally, is the most suitable time for most parts of the Transvaal; but east of Heidelberg and Springs it may be possible to sow in November with advantage.

The amount of seed used is 15 lbs. to the acre when drilled, or 20 to 25 lbs. if sown broadcast.

After-Treatment.—The plants should not be allowed to flower the first year; the crop should be kept down either by cutting or by grazing with cattle (but not sheep the first year, as they may eat the

crown out of the plants). Stock should not be left on young lucerne for long at a time; two weeks at a stretch seems to be about the limit for grazing a field, and it is a good plan to have two paddocks and to graze them alternately for ten days to a fortnight.

Seed.—At present we recommend the best Provence lucerne seed, which is quoted at about 60s. per cwt., f.o.b. London. Cape seed is sometimes cheaper, but there is much uncertainty as to its purity and, generally, much danger from dodder and other obnoxious weeds.

Besides being an excellent food for stock, lucerne is one of the very best crops for ostriches.

When feeding lucerne to stock, care must be taken to avoid cases of "hoven," "bloat" or "op-blaas." Stock will always eat greedily of this forage, and if it is at all wet from dew or rain hoven is likely to occur. Practical farmers in different parts of the world agree that lucerne should be allowed to wilt before being fed to kraaled or stalled stock, and it is safest to cut it twelve hours before feeding.—JOSEPH BURTT-DAVY.

RESULT OF CO-OPERATIVE EXPERIMENTS WITH DRY LAND LUCERNE.

Up to the date of writing, about five and twenty co-operative reports on this crop have been summarised, but owing to the exceedingly bad season the results cannot be considered at all conclusive.

Almost without exception the crop has started well and looked promising, but before it could establish itself it has been seriously damaged by sunburn, the lucerne caterpillar or locusts, and in one or two cases by hail. Some farmers have considered it a failure owing to the fact that no cut could be obtained the first year, but, as we have pointed out, this must not be expected.

A few of the trials made last year were quite successful, but the large majority are as yet incomplete, the growth of the plants being so much checked by various unfavourable agencies. It is probable, however, that many of the stands will recover and give satisfaction next year, if treated kindly during spring and summer. We strongly recommend farmers to continue the experiment of growing lucerne on dry land for at least another year, as we feel confident that in some districts, at any rate, and under certain conditions, dry land lucerne is sure to do well as a *pasture crop*, though, perhaps, not likely to give sufficiently large cuttings to make it worth while as a forage or hay crop.

We would also advise farmers not to attempt lucerne culture either on shallow soils, into which the roots cannot penetrate easily, or on the black turf soils, which rise up in dry weather and allow the plants to burn out; nor on vlei soils. A good, deep, free-working loam is the most suitable soil, and it should be stirred deeply by cultivation. The most favourable site for laying down a paddock is on the lower slopes of a hill, where a little seepage will occur during winter.—H. GODFREY MUNDY, Assistant for Plant Experiments.

No. 3.] CASSAVA AND ITS CULTIVATION.

The following notes have been prepared in answer to a request for information as to the uses and method of cultivation of the cassava plant.

Cassava or manioc is a native of tropical South America, and in tropical and sub-tropical climates, too hot and dry for turnips, swedes, mangels, carrots and other root crops, the cassava root is highly valued as a winter food for stock.

There are two kinds of cassava. The common or Bitter Cassava (*manioc ordinaire*) is extremely poisonous; the other, Sweet Cassava (*camanioc* or *manioc doux*), is much less poisonous, but is said to degenerate and then to contain the poisonous hydrocyanic acid. Both have palmately-lobed leaves, but the bitter cassava, *Manihot utilissima*, has seven divisions to the leaf, and the sweet cassava, *Manihot palmata Aipi*, only five, or fewer, divisions. Both are shrubs, 6 to 8 ft. high, somewhat resembling slender castor bean bushes, and producing large, starchy roots 1 to 3 ft. long and 1 to 6 inches in diameter.

Climate.—Being tropical plants, the cassavas require a hot climate, but can be grown some distance beyond the tropics, and thrive in the low veld and the warmer parts of the middle veld. They require at least seven months freedom from frost to come to maturity. In Florida it is claimed that sweet cassava will withstand drought better than any other staple crop. Bitter cassava is said to give a very much heavier yield than the sweet, but seems to require a warmer climate, and is less likely to be suitable for the Transvaal.

Soil and Preparation.—As cassava is a deep-rooting plant, it requires a deep, loose, well drained, sandy loam soil for its full development; heavy soils are not suitable. Wet vlei soils should not be chosen, as the roots are apt to become rotten. Deep ploughing and thorough preparation are essential to the production of a good crop.

Planting should not take place until all danger from frost is over. The plants are grown from cuttings, which may be 4 to 8 inches long; eight-inch cuttings will probably do best in the dry hot soils of the Transvaal low veld. They should be planted two in a hole, the holes 4 by 4 feet apart, which will take 2,722 cuttings per acre if planted singly, or 5,444 if planted two to a hole. Places for the holes can be easily marked by running plough furrows 4 feet apart and crossing the field again at the same distance.

After-Cultivation.—The ground must be kept free from weeds until the bushes shade the soil well, a single row of cow peas or soy beans may be sown between the cassava rows, to give an additional crop, and to help fertilize the soil. The first cultivation after the canes are up should be deep, but the second and subsequent cultivations should be shallow—as for mealies—in order not to injure the swelling roots.

Harvesting.—The tops are cut off at 4 to 6 inches above the ground and preserved for next season's planting. In our dry winters the roots may be left in the ground till required. They are usually

pulled by hand, or the deeper ones loosened with a shovel. Local conditions of soil, etc., may make other methods necessary. The yield of sweet cassava in Florida averages 6½ tons of roots per acre.

To preserve the tops for the following season, they may be cut into 8-inch lengths, and layered in newly ploughed ground with a slight slant and overlapping like shingles; cover with a layer of grass and a thin layer of soil on top, as with mangels.

Stock Feeding.—As the roots are rich in carbonaceous, fat-forming constituents, they should be fed together with peas, beans, lucerne or other protein food stuffs, to give a balanced ration.

As Human Food.—In parts of the West Indies and tropical America cassava meal and manioc cakes form staple articles of food of the negroes and Indians. The Shangaans of Portuguese East Africa and the natives of Angola also grow it extensively as an article of food, and in the middle and low veld of the Zoutpansberg one frequently sees it planted in the form of a hedge around the native kraal or mealie patch. In the West Indies the roots of the sweet cassava are cooked and eaten as a starch vegetable, either boiled in water or baked in the ashes like sweet potato. The sweet cooks more quickly than the bitter. Sir Daniel Morris observes ("Nature," January 26th, 1905, p. 305) that cassava roots are only really wholesome if used before they become too old, and when they have been cooked until they are quite soft; if the centre is hard, it is probably more or less poisonous and should not be eaten; even properly cooked cassava, which has been allowed to become cold, is not fit to eat unless it is cooked a second time.

Cassava meal or manioc is prepared by peeling the root, then grating it, and pressing out the poisonous juice by levers or screws applied in any convenient way; the residue, dried over the fire, loses all its poisonous properties, and forms the manioc flour or cassava meal. It is eaten in the form of bread. If well dried and kept closed from the air, cassava meal will keep for a long time; if exposed to a moist air, however, it quickly becomes mouldy.

Moussache is the starch of the cassava meal, prepared by washing the fresh pressed meal to separate the cellulose and broken tissues, the starch settling in the water. It is used in the preparation of glucose and tapioca, and for dressing linen.

As a source of commercial starch an acre of cassava will produce about 2,400 lbs. of starch, while an acre of mealies, yielding 12 bags, will give only 1,200 lbs of starch, or only half as much as the cassava. "It thus appears that cassava is to-day the cheapest known source of starch, costing at present market values of raw material only about one-fourth as much as its nearest competitor."

Tapioca is a very nutritive, easily digested form of starch obtained by heating rapidly the dried moussache added to a fourth part of manioc simply grafted, upon heated plates of sheet iron. The starch grains swell, uniting in small masses, and undergoing a transformation which gives them a vitreous appearance and renders their digestion much more easy.

Piwarrie, an intoxicating beverage, is also made from cassava cakes by fermentation.

The result of experiments conducted by the Florida State Agricultural Experiment Station shows that—"All things considered, cassava comes nearer furnishing the Florida farmer with a universally profitable crop than any other which he can grow on equally large areas. It can be utilized in more ways, can be sold in more different forms, can be more cheaply converted into staple and finished products, and can be produced for a smaller part of its selling price than any other crop." This somewhat rosy description is probably more applicable to the economic conditions of the Southern United States than to those of the Transvaal, but is useful as showing how valuable this crop may become even in warm temperate climates similar to ours.

Poisons.—All parts of the bitter cassava plant, and perhaps, also, of the sweet cassava, produce a bitter, poisonous juice. The juice extracted from the root in the preparation of cassava meal contains so much hydrocyanic acid (as much as .02% has been found in the root) that it is extremely dangerous, and in the West Indies many deaths occur from carelessness in the disposal of the juice. The greatest care should be taken to keep it away from children and animals. In Guiana it is stated that the Indians use red peppers, or chillies (fruits of *Capsicum annuum*), steeped in rum, as an antidote for this poison.

This juice can be made into a valuable by-product known as *cassareep*. The juice is boiled down until it resembles molasses in appearance, when it becomes a powerful antiseptic, capable of preserving meat in a fresh condition for some time.

Parasites.—In moist plantations of cassava near Calunga, Pungo Andonga, Angola, Welwitsch found plants of *Alectra lancifolia*, Hemsl., apparently a root parasite, but he does not state that they were actually parasitic on the cassava roots. Alectra belongs to a group of plants (*Scrophulariaceæ*), many of which, like our Rooiblommetje (*Striga lutea*), are root parasites, and it is quite likely that it, also, is parasitic.—JOSEPH BURTT-DAVY.

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No. 4.]

COLLECTION AND EXTRACTION OF CASTOR OIL SEED.

Some varieties of the Castor bean plant do not shed their prickly husks as readily as others, and prospective growers have been making enquiry as to the possibility of securing a machine which would do this work efficiently, and thus save time and labour. The Director of the Imperial Institute was approached for the latest information on the subject, and has courteously responded as follows;—

"With reference to Mr. Burtt-Davy's letter No. 1130, dated the 12th May, 1906, asking for information on the subject of machinery suitable for extracting castor oil seeds from the ripe carpels, I have made numerous enquiries but have not yet heard of any special

machine which is used for this purpose. I enclose copies of extracts from several reports and publications on the subject, which will indicate the methods adopted in various countries for separating the seeds from the carpels. In those cases in which the seeds are not liberated from the fruits on ripening, it appears to be customary to soften the capsules by allowing a slight fermentation to take place, and then, if necessary, to submit them to pressure either by beating or by means of a light roller. I can only suggest that this method should be tried in the Transvaal. If it is not successful I shall be glad to make further enquiries with a view to the production of a suitable machine. It is possible that a modification of the machine used in America for shelling ground-nuts might be suitable.

Watt's Dictionary of economic products in India, Vol. VI., gives the following information:—In Madras the seed pods are piled up and covered with straw, and a weight placed on the straw to exclude air. After six days the rotted and soft capsules are exposed to the sun and beaten with a heavy wooden mallet, whereby about half the seed is separated. The remaining capsules are dried and re-treated in the same way. The refuse is separated by winnowing and used as fuel. In Bengal the fruits are placed in a ditch. A little water mixed with cow dung is spread over them and they are then covered with a mat or piece of gunny. After three days they are taken out and put in the sun, when the shells leave the seeds. In the Dacca Division the capsules are merely covered for six or seven days, after which they are exposed to the sun for three or four days and then separated from the shell. In the Orissa Division the ripe capsules are left in a heap for three to five days, a mixture of cow dung and water being sprinkled over them. They are then exposed in the sun to dry. Most of the capsules burst themselves, and those that do not are opened by means of a mallet. In the North-West Provinces the pods are either dried in the sun and broken by rolling, or are buried in the ground and allowed to rot.

Semmler, in his 'Tropische Agrikultur,' states that the gathered capsules are spread out in a dry place and exposed to sunshine in layers 10 centimetres deep, where they are turned over from day to day. This drying place should be surrounded by a wall a metre high, so that if the seeds are violently dispersed by the capsules none may be lost. In good weather most of the capsules will have dehisced in the course of 4 or 5 days. In order to get the remainder out, a light roller is repeatedly drawn over the capsules by an unshod horse or by two labourers, the heap being continually turned so as to expose all the capsules to the action of the roller; the shells are then removed by winnowing.

There is an article on 'Ricinus Kultur' by A. Zimmerman in 'Der Pflanzer,' 1905, in which he states the capsules should be collected several days before they are fully ripe, and that the capsules as a rule split easily as they become dry.

In the case of capsules which do not rapidly dehisce, the usual plan is to pile them up in heaps, cover them with straw, and allow

them to ferment for 6 days, by which time the walls of the capsule have softened and the seeds may be readily extracted. The author states that in trying this method he did not get good results."

(*Signed*) WYNDHAM R. DUNSTAN,

July 27th, 1906. *Director, Imperial Institute.*

We have recently been shown a hand machine, made in Pretoria, for the purpose, but on putting it to practical test the result was quite unsatisfactory. The most economical method of treatment known to us at present is that practised in America, where the pods are placed in heaps within a three-foot high enclosure to ripen and open in the sun.—JOSEPH BURTT-DAVY.

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No. 5.]

NOTES ON THE CULTIVATION OF BROOM CORN,

Andropogon sorghum technicus.

The question of commercial success with broom corn is an economic and not a cultural one, depending largely on labour. A broom factory has been established near Capetown, and the manager informs us that he is able to use 100 tons of broom corn heads per annum.

As pointed out in our last annual report, p. 264, there is an extensive and flourishing industry in broom corn brooms in California, where labour is scarce and expensive; yet the finished article is retailed in San Francisco at 25 cents. (1s.) for common brooms, up to 50 cents. (2s. 1d.) for the best make. Here the retail price is 2s. 9d. to 3s. 6d. respectively, which should leave a margin of profit.

Broom corn has given excellent results at the Experiment Stations at Skinner's Court and the Springbok Flats, and on the Experiment Farm at Potchefstroom. It is cultivated as easily as Kafir-corn or Zoet-riet (*Sorghum* or *Imfe*), to which it is closely related botanically.

It requires rich soils, and an application of well-rotted stable or kraal manure, well mixed with the soil, will be very beneficial, to which might be added, if available, 200lbs. per acre of acid phosphate. Lands that are foul with sweet grass (*Chloris virgata*), mist breede (*Amarantus*) and other weeds, are not suitable, for broom corn is slow at starting and the young plants are not very vigorous, so that weeds are apt to get ahead of the seedlings, injuring them and further retarding growth. The use of a preparatory cleaning crop, such as potatoes or velvet beans, is therefore desirable. It is most important that the soil should be in good condition before planting, so that the seedlings may come on without check.

In good clean land the seed should be drilled in rows 3 to 3½ ft. apart, with one plant every three or four inches in the row, or 6 to 8 inches on poor land. Unless good cultivation and cleaning are

practised, however, this distance will be too close. A "Planet Junior" hand drill can be used to advantage.

Allowance must be made for some thinning out after the plants are up, also for immature seed and for seeds not perfectly covered, as well as for loss from mealie grub, etc., so that 3 to 4 quarts of seed per acre will generally be required for a good stand. Frequent after cultivation is most important, to prevent check from weeds or drying out of the soil by caking. Thin to the proper distance when 3 or 4 inches high.

Broom corn is sometimes attacked by a *smut*, which injures the heads, resulting in a crop of inferior quality. If readers of the "Journal" find any diseased heads in their crop, we shall be glad to have specimens for investigation.—JOSEPH BURTT-DAVY.

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No. 6.] PEA-NUT PLANTING.

The usual amount planted per acre is the seed shelled out of two bushels of pods; a bushel weighs about 22 lbs. Seed should never be planted till all danger of the young plants being injured by a late frost is over. The seeds may be sown either in check rows or in drills. In check rows the cost of planting is probably greater than in drills, but if the land is old and weedy the cost of cultivation in checks would be less than in drills, as one could use a horse-hoe both up and down and across the field, very close up to the young plants, leaving little to be done by the hand hoe. The distance between the hills or drills must depend on the fertility of the soil and on the variety grown, some varieties running much more than others. In very fertile soil, and with a running variety like the "Virginian," 3 to 3½ ft. square each way between the checks, or 3 ft. between the drills and 14 inches between the plants in the drill, will sometimes be necessary; with more compact varieties and in less fertile soil the distance can be reduced; experience is the only safe guide in this respect.

For marking off the check rows, Mr. R. B. Handy, of the United States Department of Agriculture, recommends the use of a simple and inexpensive marker. This consists of "a piece of scantling 4 x 4 inches and 6 or more feet long, through which are inserted, at distances equal to the required distance between the hills, wooden pegs 2 x 3 inches and 18 inches long, shod at the ends with iron. To the main bar are attached a pair of shafts and handles to be used in drawing and guiding the implement. The cross marking is usually performed with a small turn plow, the droppers following it putting two seeds to the hill, covering them over with the hoe, or, probably more commonly, the foot, to a depth of 1½ or 2 inches, although some cover the seed with a small plough."

"There is in use among pea-nut farmers," adds Mr. Handy, "a planter planned somewhat after the manner of a cotton seed planter. It is drawn by one horse and is fitted with a 'shoe,' at the base of

which the kernels are dropped at distances from 8 to 20 inches apart, according as the machine is geared, and are covered by a concave wheel, which, passing over the furrow, presses the soil firmly down upon the seed."

The average yield per acre varies from 17.6 bushels (of 22 lbs.) up to 30, 50 and even 60 bushels, according to soil, climate and cultivation, but in some States 100 bushels is not an uncommon yield.—JOSEPH BURTT-DAVY.

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No. 7.] DUIVELS-DIS.

Pretrea zanguebarica, J. Gay ; Family *Pedaliaceæ.*

The injurious character of the fruits of this weed were alluded to in my annual report for the year 1903-04, p. 320, and again in the "Transvaal Agricultural Journal," Vol III., No. 12, p. 764 (July, 1905), in which an illustration of the plant from the pen of Mrs. Burtt-Davy was given (Plate LXXXVIII).

The Duivels-dis is a native of the Transvaal, and is abundant in the light sandy soils of the middle-veld north of the Magaliesberg, in the Pretoria, Rustenburg, Marico, Potchefstroom, Waterberg, Zoutpansberg and Barberton districts. It is also likely to be found in the Lydenburg, Middelburg, Piet Retief, Wolmaransstad, Bloemhof and Lichtenburg districts, but we have no actual record of its occurrence there.

Some farmers are of the opinion that the weed is becoming more abundant in the country, and this is quite likely to be the case. The fruits of the plant are remarkably well fitted for seed dispersal on account of their peculiar structure. Each fruit consists of a more or less circular disc an inch in diameter, flattish on one side and rounded on the other, from which protrude two straight, erect, firm and hard thorns or doorns with sharp points, resembling a large boot protector, thumb tack, or drawing pin with two points. The "tack" lies on its "head" on the ground, with the two points standing straight up in the air, awaiting the passing of some soft-footed animal. When trodden on by a passing donkey, mule, horse, ox, goat, sheep, dog or barefooted native, the hard sharp points of these discs become firmly embedded in the flesh or soft part of the pad or hoof, and the fruit is carried about in this way from place to place; constant rubbing of the fruit against the hard ground and stones, wears off portions of the shell of the fruit, finally allowing the seeds to drop out, ready to start a new colony when the warm rains of summer allow them to germinate. Finally, the whole shell is said to break away, leaving the two thorns deeply embedded in the hoof or foot. The animals become crippled, and soon show signs of weakness and emaciation, being unable to travel about well in search of food and drink. In the case of donkeys, the punctures in the hoof may allow of the entry of injurious bacteria, causing footrot, which has been quite troublesome in some districts in the summer.

Mr. P. J. Vermaas, of Makokskraal, Potchefstroom District, has sent a parcel of 30 of these duivels-doorns, extracted one morning from the feet of his sheep.

The eradication of this weed from stock farms is most desirable. It grows in rosettes, flat on the ground, producing a number of long runners in every direction. These produce pinkish or lilac coloured, tubular flowers, which afterwards give rise to green fruits with soft green thorns, and these in turn become hard and brown.

Wherever the weed occurs in quantity, it would be well to have the plants chopped out with the Kafir hoe, taking care to cut the roots as deep down as possible, and well below the crown of the root.

In order to be effective, this work must be done early in the summer, when the plant is in flower and before the doorns ripen, in order to prevent new crops being started. It is probable that the doorns and seeds may remain a long time in the ground—perhaps several years—awaiting favourable conditions for germination, and it is therefore unlikely that the weed can be cleared from a farm in a single season. As is the case with all weed eradication, patience, perseverance and thoroughness are essential to success.—JOSEPH BURTT-DAVY.

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No 8.] LAWN GRASS MIXTURES.

The Agrostologist receives many enquiries about grasses suitable for lawns. This is a subject which does not at present appeal to the majority of farmers, who are necessarily more interested in establishing their flocks and herds and raising crops that will sell, than in the cultivation of a garden lawn. But a resident of the larger towns, who can rarely get away to the veld, has an innate craving for something green to refresh his weary eyes after a day in the dusty brownness of the streets. And the time will doubtless come, as the country develops, when more lawns will be grown in farm gardens.

An agrostologist being a man who studies grasses (the word agrostology means the botany of grasses), he is naturally supposed to know something about grasses that will grow on lawns as well as those suitable for sheep camps. Our experiments with winter pasture grasses have given some information as to the kinds best suited to the Transvaal winter, and also as to those which are unsuitable. Some of those which have proven satisfactory for winter pasturage can be used to even greater advantage as winter lawn grasses, where they will receive a little irrigation once or twice a week.

Two or three experimental lawns have been laid down in the suburbs of Pretoria during the past winter, which have given most satisfactory results up to the present. One of these was composed entirely of Rescue grass (*Bromus Willdenowii*) or, as it is sometimes called, *Bromus Schraederi*. This was watered only once a week, and gave a beautiful and refreshing greenness throughout the winter. It was kept closely cut with a lawn mower. Rescue grass is essentially a

winter growing species, however, and we fear it may not last through the summer.

Another beautiful lawn, which has attracted much attention, is that at the New Government House, Bryntirion. This was composed principally of Tall fescue, Reed fescue and Pacey's Perennial Rye grass. From our experiments at Skinner's Court, we have every reason to believe that this lawn will keep green, with a little water, throughout the whole year.

European and local seedsmen often recommend lawn mixtures for very dry soils which, though relatively well adapted to the *relatively* dry soils of Europe, have proved either totally or partially unsuited to the *extremely* dry conditions of a Transvaal winter. We have analysed and tested many of these samples and have found, in every case, that while they usually contain some kinds suited to the climate, they include large quantities of seed of varieties which have proved quite unsuitable, and some of which are quite expensive. Some of these lawn mixtures contain up to 40% of such unsuitable grasses. This means that for every 100 lbs. of seed required for a lawn, one must buy an additional 40 lbs. of the mixture to make a good stand, or the lawn will be patchy. In other words you are asked to pay 40% more than you otherwise need, for seed which will do no good. It is not at all probable that there is any intention to defraud the public in this matter. The seedsman sells the mixture because it makes a good lawn when sown in the quantity he recommends. The composition is made up for him in Europe by a seedsman who draws his conclusions from a dry European summer, and probably no one has, until now, taken the trouble to sort out the different kinds of seeds and sow each one in plots to see which of them survive.

The Department of Agriculture has done this, and has found that the mixture which appears to be the best suited to Transvaal conditions is composed of the following, all of which have proved satisfactory here with a minimum of irrigation:—

Tall fescue	1/3rd.
Meadow fescue	1/3rd.
Pacey's Perennial Rye grass ..	1/6th.
Italian Rye grass	1/6th.

Soil.—In laying down a lawn it should be borne in mind that proper preparation of the soil is only second in importance to proper seed. The ground on which the lawn is to be laid down should be thoroughly trenched to a depth of two, or better, three feet, and well mixed with *thoroughly rotted* kraal manure. Fresh stable manure should on no account be used, as it will bring so much mist breede and other weed seeds into the lawn, which it will be practically impossible to eradicate, and which will always leave it looking shabby and a trial to the eye instead of a pleasure. In this case an ounce of prevention is worth many pounds of cure.

A top dressing of equally well-rotted kraal manure in winter will do much to keep the lawn in condition.—JOSEPH BURTT-DAVY.

No. 9.] BOTANICAL NOTES.

THE LILIACEÆ OF THE TRANSVAAL.

The Liliaceæ form a conspicuous feature of the flora of the Transvaal. In midwinter the kopjes are bright with the showy reds and yellows of the Aloe blossoms, which attract honey bees by the hundred, and around which may be seen darting on warm days metallic-hued honey birds. In early spring, before the grass is green, the Scillas and other Liliaceæ mingle with their near relatives the Amaryllids, in giving colour to the otherwise sombre veld ; thus they attract more general attention than many other groups of plants equally common.

Not only are they conspicuous by their early-flowering habit, but some of them, like the slang-kop and chincher-in-chee, are highly poisonous to stock, and are thus rendered unpleasantly conspicuous to the farmer.

Some have medicinal uses, and others, again, yield strong fibres, which may possibly become of value in the manufacture of cordage, twine, etc.

On account of their general interest to Africanders, it is desirable that we should know something more about the many species of this large plant family which occur on our veld, and with this end in view the Director of the Transvaal Museum has agreed to allow Miss Leendertz, Curator of the Museum Herbarium, to prepare keys to the Transvaal genera and species of the Liliaceæ, with short descriptions by which they may be distinguished and their proper names assigned to them.

In order to do this properly, Miss Leendertz must be supplied with plenty of material, and as there are many species which do not occur near Pretoria, readers of the "Journal" are asked to send fresh specimens of any wild "lilies" or lily-like plants they may find growing on their farms. Specimens may be sent free of charge by rail or post if addressed—

O.H.M.S.
The Director,
Transvaal Museum,
Pretoria.

The package should contain a letter with the name and address of the sender.

The writer's card catalogue shows that there are at least 34 genera and 149 species of Liliaceæ in the Transvaal, but there is no doubt that there are many more as yet unrecorded, and we hope that school children, and grown up people as well, who are interested in flowers, will contribute specimens to make the museum collection and Miss Leendertz' manuscript more complete.—JOSEPH BURTT-DAVY.

PEA-NUTS (*Arachis hypogæa*) IN THE WATERBERG DISTRICT.

A farmer near Warmbaths grew 3 acres of pea nuts last season and has harvested an average of 2,000 lbs. (25 bags of 80 lbs. each)

per acre. The seed was planted in rows 18" x 2' 6" apart, and 80 lbs. of seed planted 3 acres. Last season was, of course, anything but a favourable one, but the pea nuts gave a fair yield though mealies planted on the same day yielded no crop. The soil is a sandy loam; heavy soils do not suit this crop, many of the nuts failing to develop in hard, stiff soils. Harvesting is rather an expensive item, as at present it is all done by hand. In America, however, a machine is used, drawn by two mules, which much reduces the cost of labour. The crop took about five months to mature. Sample lots sold in Johannesburg brought 14s. 6d. per 100 lbs. in the shell, or 23s. 6d. per 100 lbs. shelled.—JOSEPH BURTT-DAVY.

VELVET BEAN (*Mucuna utilis*) THRASHING.

In reply to an enquiry made by this Division as to the method of shelling velvet beans adopted in Florida, a correspondent writes:—

"In regard to the matter of separating the seed of the velvet bean, I may say that the local machinists have altered the coffee bean huller in such a way as to make it useful for taking the pods from the beans. This is where the seed is prepared on a large scale. At my own place we simply dry the beans in the sun and then place them in a sack and have a coloured man pound them thoroughly. In this way a very considerable lot can be hulled out at a comparatively small expense. It will cost us not more than 25 to 50 cents. a bushel in this way, and as it can be done at home the cost is probably less than that. All that is necessary is to see that the beans are thoroughly dry before they are put in a bag, and then that they are pounded at once. For general planting purposes it does not matter if a small amount of the bean hull does adhere to the seed, and for commercial purposes a few that are left in the hulls make no special difference."

* * * *

DISC-CULTIVATING LUCERNE IN NEBRASKA, U.S.A.

The following notes on the increased returns obtained from lucerne by disc-cultivating are furnished to the "Twentieth Century Farmer" by an American grower; alfalfa is the Spanish and American name for lucerne:—

"In a dry spell, just after the lucerne has been cut and stocked, it has paid us well to disc the land. We disc both ways, then harrow smooth.

The increased yield may be 25 to 54% or more of a full crop; hence a man might make \$10 to \$15 per day at this job if well and promptly done. This applies to alfalfa three or more years old. Some however, have disced it when only two years old, and report good results. We prefer to use a sharp level harrow at this stage of its devolopment.

In a thin stand the disc may be set at a sharp angle, with a thick stand at a less angle. Set the discs to a good depth so as to cut through the crust formed, and turn the soil well over.

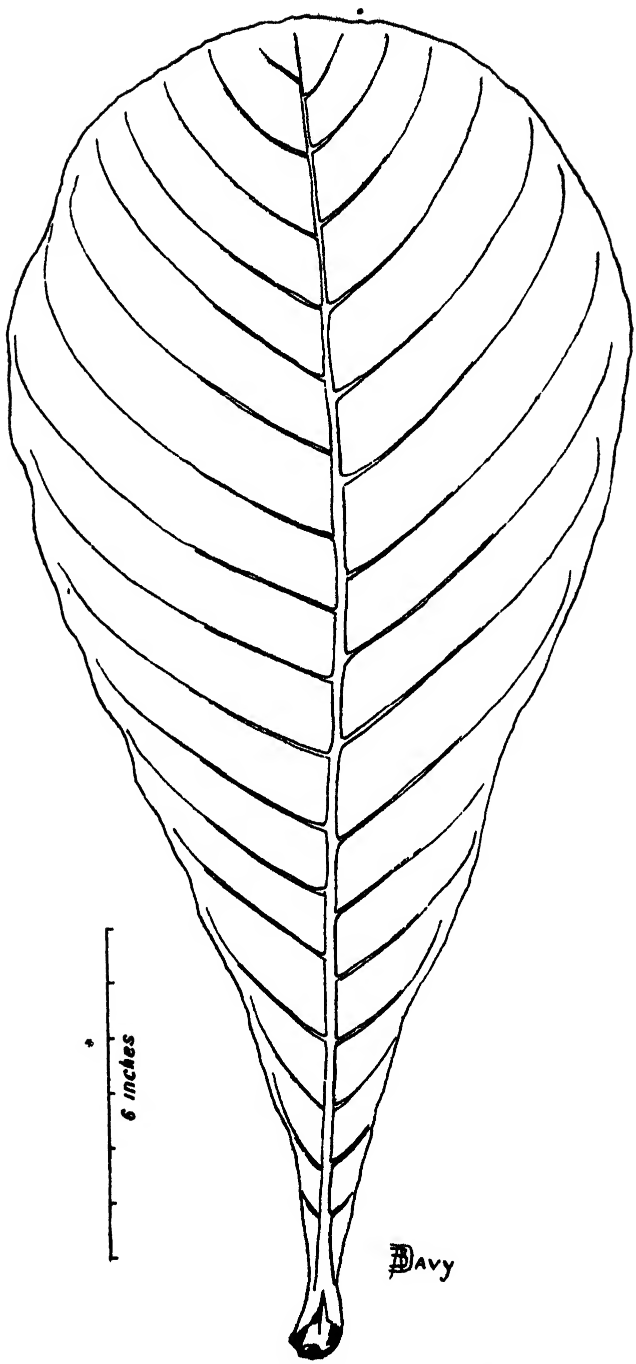
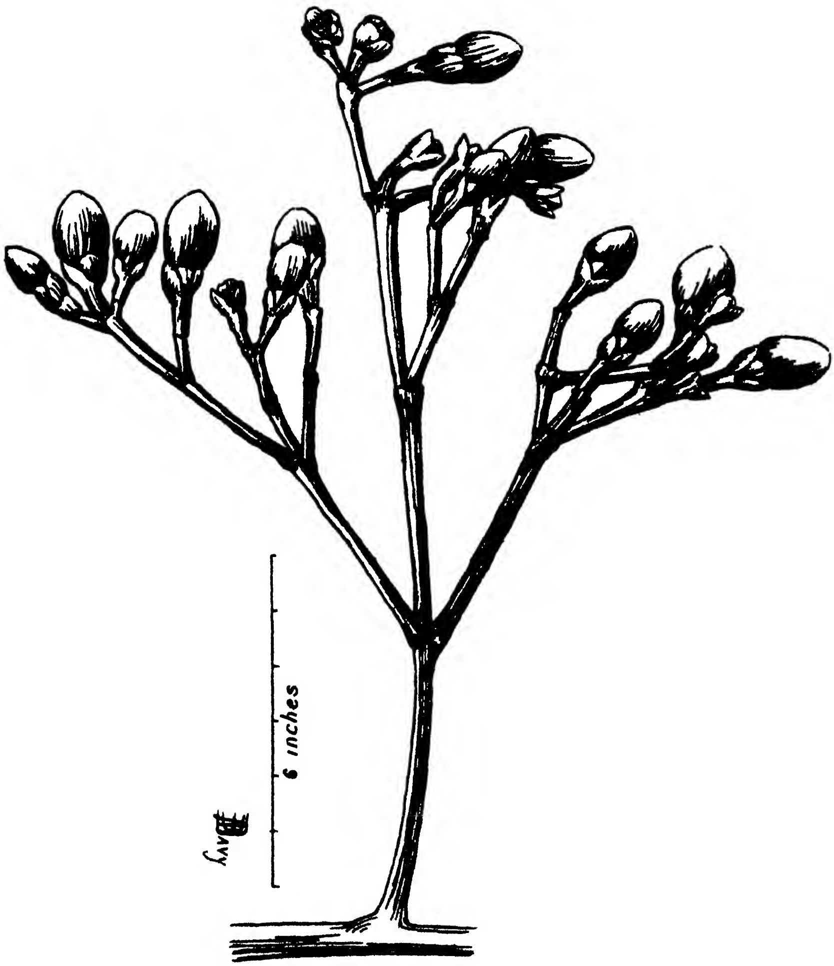


Plate CXXXIV *Anthocleista insignis*, Galpin, leaf, much reduced.



Anthocleista insignis, Galpin, portion of inflorescence, with immature fruit.

Plate CXXXV.

Besides thickening the stand of alfalfa, hastening its growth and conserving the moisture, much good will be done by eradicating weeds, cut worms, grass, etc.

We often see fields where weeds and grass are crowding out the alfalfa and nothing is done to check their progress; get all you can out of the alfalfa crop; prairie grass is short and thin.

For best results, and to make it easier for the team, the disc should be sharp. Repeat the discing after each successive cutting. If crowded for time, at least make sure of the worst of the brak spots."

* * * *

Notes on the Illustrations.

Plate CXXXIV., *Anthocleista insignis*, Galpin, shows a single leaf, drawn by Mrs. Burtt-Davy from a specimen obtained from the same tree shown in Mr Altenroxel's photograph in Plate CXLIV. This species was first found and described by Mr. E. E. Galpin, of Queenstown, Cape Colony, who then lived in Barberton. It is not infrequently met with in shady creek beds in the mountains about Barberton; at the Adamanda Mine, Three Sisters, near Louw's Creek; and near Haenertsburg. The bark is said to be a valuable febrifuge.

Plate CXXXV. shows a small portion of the large inflorescence of *Anthocleista* with young trees. The tree is so high and the trunk so smooth and branchless that Mr. Altenroxel had to shoot off the fruiting branch with a rifle.

THE ENTOMOLOGICAL SECTION.

THE BAGRADA BUG.

(*Bagrada hilaris.*)

By C. W. Howard, B.A., Assistant Entomologist.

For some years it has been very difficult to grow cabbages and cauliflowers in the Transvaal on account of the ravages of the Bagrada Bug. It seems to be of universal distribution over this sub-continent, and has done a great deal of damage in Cape Colony, Natal, and Zululand, as well as in the Transvaal In the Transvaal it is present everywhere, being reported from places of every elevation and regions widely separated, like Louis Trichard, Barberton, Swaziland, Rustenburg, and Johannesburg. One of our correspondents in Barberton reported that a crop of cabbages was destroyed by this insect, which cost £50 to plant. Another correspondent lost, recently, a crop of cabbage worth £200, and many other reports tell of the loss of the entire crop. In Pietersburg and vicinity it is necessary to import cabbages from Johannesburg and Cape Colony. In Cape Colony the insect seems to have its ups and downs; some years being very abundant and in others doing little damage. We have hoped that such would be the case here, but for the past three years there has been no sign of any decrease.

The first mention of this insect in South Africa is in the "Cape Colony Agricultural Journal" for July 21, 1898. In that article Mr. Lounsbury says that reports of its destructiveness had been numerous during the year, and came from widely separated regions. He considered it, at that time, an insect indigenous to the country but which rarely became a pest. In the report of the Natal Entomologist 1903-4, Mr. Fuller records it, not as an insect newly introduced, but as one which had done considerable damage during the previous eighteen months.

In the U.S.A. there is an insect belonging to the same family as the Bagrada Bug, and closely resembling it in size and colour. This insect is known as the Harlequin Cabbage Bug (*Murgantia histrionica*). It began its work in the southern States, and has gradually spread northward until now it is found throughout the southern and eastern States, except in the extreme north-east. Its food, like the Bagrada, consists of cabbage, cauliflowers, and other cruciferous plants, and its other habits are very similar, but it is a much easier insect to combat than the Bagrada Bug, owing to the fact that the winters in the part of the United States where it is found are much more severe than in the Transvaal, which compels it to remain concealed in some protected place during that season, and makes its trapping in the spring an easier matter.

Classification.—The Bagrada Bug belongs to the order of insects known as *Hemiptera*, the True Bugs. In some parts, all insects are known as bugs, but technically this is the only group which can receive that name. Further, it is a member of the family *Pentatomidæ*, one of the sub-divisions of this order. Members of the family *Pentatomidæ*, or Stink Bugs, are very abundant in South Africa, and can be easily distinguished by their flattened appearance, triangular shape, and the foul odour which most of them emit when handled roughly. The technical name for the Bagrada Bug, according to the South African Museum at Capetown, is *Bagrada hilaris*. In the absence of any previous common name, Mr. Lounsbury, Cape Government Entomologist, christened it Bagrada Bug in 1898.

All the members of the order *Hemiptera* obtain their food by sucking. If a Bagrada or any other bug be examined, there will be found on the lower side of the head a long, jointed tube carefully folded back between the legs along the lower side of the body. This tube contains several sharp bristles, and when the insect wishes to eat, the tube is brought forward, inserted into the plant tissues, and the juices sucked up through it. This method of feeding makes them a much more difficult group of insects to combat than the chewing insects, for they are perfectly immune to any stomach poison which might be sprayed on the plant.

Its Work.—Considering the method mentioned above, by which the Bagrada Bug eats, one would not expect to find the results of its work very evident. But such is not the case; it can be detected at once. It sucks the juices from the leaves of the cabbage or other plants so rapidly, and in such quantities that nothing but the tissue is left, and the leaves soon shrivel up and dry, making the plant look as if it had been scalded with boiling water or burned. Young plants soon succumb entirely and dry up, while older plants are seriously hindered.

Food Plants.—The food of the Bagrada is mostly confined to cruciferous plants (the Mustard Family) among which cabbage, cauliflower, kohl-rabi; turnips and radishes suffer the most. But it is also fond of mustard, wall-flowers, stocks, candy tuft. and alysseum, and often attacks nasturtiums, which belong to the family *Geraniaceæ*, and has even been reported as injuring mealies, wheat, and holyhocks. A few were found on Cape gooseberries at Pretoria last year, and oviposited on the plants, but they seemed to find it uncongenial and soon left.

In our experiences at Pretoria, we have found that it prefers mustard first of all, next to this radishes, turnips and nasturtiums. Even when cabbages were in the plot next to these plants they were not touched until the mustard and nasturtiums were all finished. So eager are they for mustard that, when numerous, they will scarcely allow it to acquire its third leaves unless it is protected by a netting.

Description and Life History.—The adult Bagrada is a small, flat insect from 4 to 7 mm. (.16 to .28 in.) long, the male being only

about two-thirds as large as the female. They are triangular in general outline. The broad end in front is formed by a narrow, almost rectangular plate, in front of which projects the small head; backward from the plate extends a large triangular shield, on each side of which are the wings. The upper pair of wings are thickened and stiff at their bases, and so arranged that the thin membraneous tips overlap each other. The general colour is black, but there are numerous symmetrically arranged orange and yellow streaks and spots on both upper and lower surfaces. In fact, the lower surface is nearly all yellow in most specimens. The eggs are small, barrel-shaped affairs, about ¾ mm. long by ½ mm. wide, rounded on the lower surface, but rather flattened on top, with a groove running around the edge, forming a lid. Along this line the egg breaks when the young insect hatches. The surface of the egg is smooth and glossy, at first a creamy white, but gradually becoming a deep orange in colour as it nears the time of hatching. The eggs are deposited, singly or in groups of three or four, but are never set in regular rows, side by side, as with most insects of this family. Sometimes they stand on end supported by leaf hairs, or often on their sides. The mother usually places them on the under side of leaves or about the bases of leaf stalks, where they are protected, and seldom on the upper surface.

The Bagrada passes through an incomplete metamorphosis, that is, the young insect which hatches from the egg resembles the adult insect in general appearance and assumes the adult form by a series of moults, and not by a resting stage as with butterflies and moths. The young Bagrada just hatched is about 1 mm. (.4 in.) in length, and resembles the adult in shape, except that it is not quite so flat, and possessess no wings. The head and thorax are black, and the abdomen of a deep orange colour with a row of black spots down the centre, and another of black triangles all around the edge. At each moult, these black spots become larger and larger until at the last stage, just before the adult, there are only a few reddish spots left on the abdomen. These immature forms, or *nymphs*, as they are called, moult five times, producing the adult insect at the last moult. With each moult the wing pads, black, triangular projections from the hind edge of the thorax, become larger and larger, until finally the full-sized wings are produced.

The number of generations in a year has not yet been determined. During the summer the adults began to lay eggs in 8 or 9 days after copulation. In 9 to 13 days the eggs hatched, while the nymphal stage lasted from 35 to 40 days. In the low veld they seem to be more active during winter, and may breed throughout the year. In the high veld the devolopment seems to be retarded in the winter; at least, about Pretoria the insects hide under rubbish and in cracks in the soil during cold periods, only coming out when it is warm. It has been impossible to obtain any eggs at Pretoria this winter, or to make nymphs complete their development, until the latter part of the winter when it began to get warm. In Cape Colony the bug is said to breed throughout the winter, but its development is retarded somewhat, and it is not destructive at that season.

Prevention.—No natural enemies of the bug have been found in the Transvaal, but the fact that it is abundant some seasons in the Cape Colony, and not others, seems to point to the work of some parasite in that country, and we are at present negotiating with other entomologists for the importation of such parasites, whenever possible. All remedial remedies must be in the nature of prevention rather than direct destruction. Owing to the method by which the insect eats, sprays which act as stomach poisons, such as Paris green, or arsenite of soda are useless; some contact insecticide, such as resin wash, must be employed when spraying is feasible.

Clean culture and cleanliness about a farm are two essential points in its suppression. The Bagrada must have shelter to protect it during the cold spells of winter, hence if all rubbish is removed from the fields there is no place for it to hide. All remains of crops, such as cabbage and cauliflower stumps left in the field over winter, furnish it nourishment, as do all remains of stocks, wall-flowers, nasturtiums, or other favourite food plants. Hence all such plants should be pulled up and burned, or destroyed in other ways, as soon as they are finished with. All weeds belonging to the mustard family should be destroyed, and not allowed to grow on the farm. Such cruciferous weeds growing in the Transvaal are the following, some of which are natives, while others have been introduced from other countries:—

Natives.

Brassica strigosa, Dc., Klippan, Boschveld.
Brassica strigosa glabrata, Mooi River, Kariebosch.
Cardamine africana, Linn., Woodbush, Barberton.
Heliophila pusilla, L., Woodbush.
" *rigidiuscula*, Sond., Barberton.
" *sp.*, Johannesburg.
Nasturtium indicum integrifolium, Dc., Pretoria.

Aliens.

Barbarea præcox, R. Br., Pretoria.
Brassica campestris, L. (Wild Rape), Standerton.
" *nigra.*, Koch. (Black Mustard), Standerton.
Capsella bursa-pastoris, Mœnch (Shepherd's Purse), Belfast, Johannesburg, Pretoria.
Coronopus didymus (L.) Smith (Wart Cress), Pretoria.
Lepidium capense, Thunb. (Cape Pepper-Cress), Pretoria and Belfast.
Nasturtium officinale, R. Br. (Water-Cress), Aapjies River; near Standerton, Johannesburg.
Raphanus raphanistrum, Linn. (Jointed Charlock), Potchefstroom, Belfast.
Sisymbrium capense, Thunb. (Cape Mustard), Standerton.
Eruca sativa, Pretoria.

The above list was compiled by the Government Botanist, Mr. J. Burtt-Davy, and further information regarding them may be obtained from a paper by him entitled, "Alien Plants Spontaneous in the Transvaal," and published in the Report of the South African Association for the Advancement of Science for 1904.

If a crop is destroyed or hopelessly damaged by the insect, have it removed at once, thereby destroying most of the bugs on it. Never plant cruciferous crops which grow at different seasons near each other, otherwise the insects will pass readily from one crop to the other and destroy both. And always rotate the crops if possible; that is, plant the cabbages in a new place each year, removed as far as possible from the plot utilized the former year, and plant some crop of an entirely different character on the old plot.

Great results can be obtained in the way of clearing the ground of the bugs before planting. This can be done by putting out piles of old rubbish in the field where the plants are to be set. The insects will collect in these, and they can be destroyed. A much better scheme is to place leaves of old cabbage, or even such plants as castor oil, on the ground. The bugs assemble under them on cold nights, and a boy can go about early in the morning and shake them into a tin upon which a little paraffin has been poured.

That the bugs are so fond of mustard is very fortunate. A small plot can be planted in the field to be used for cabbage or cauliflower later. This should be protected by a covering, which can be easily made of a frame-work of a few stakes and wire with butter cloth stretched over it. Such a covering for a plot eight feet square need take only 13 yards of butter cloth, at a cost of 3s. 3d. The edges of the cloth should be held down firmly with earth. After the mustard is fully grown the covering can be removed, and the bugs will gather upon it in great numbers. Then it should be destroyed, and with it the bugs, by burning or spraying thoroughly with pure paraffin. In some cases it might prove easier to grow the mustard in tins in the house, and remove it to the fields when needed, destroying it in the same manner after the bugs have gathered upon it.

After the ground has been thoroughly cleansed of bugs in the above ways, the cabbage can be planted, and will be unattacked until large enough to resist. If, howeve, the bugs are present in unusual numbers, rows of mustard might be planted again between the rows of cabbage, and destroyed after the bugs have gathered on them and the plants have become large.

Instead of the above method, very good success has also been obtained by netting the cabbage until well grown. This is done by inserting a small stick beside the plant and stretching over it a small square of butter-cloth, pressing down the sides of the cloth firmly with soil. Old tins have been tried but proved useless, as they did not let in enough light and air to the plant.

When the plant becomes larger the bugs have often been kept in check by the use of resin wash, or castor oil emulsion. Other contact insecticides such as paraffin emulsion would be equally

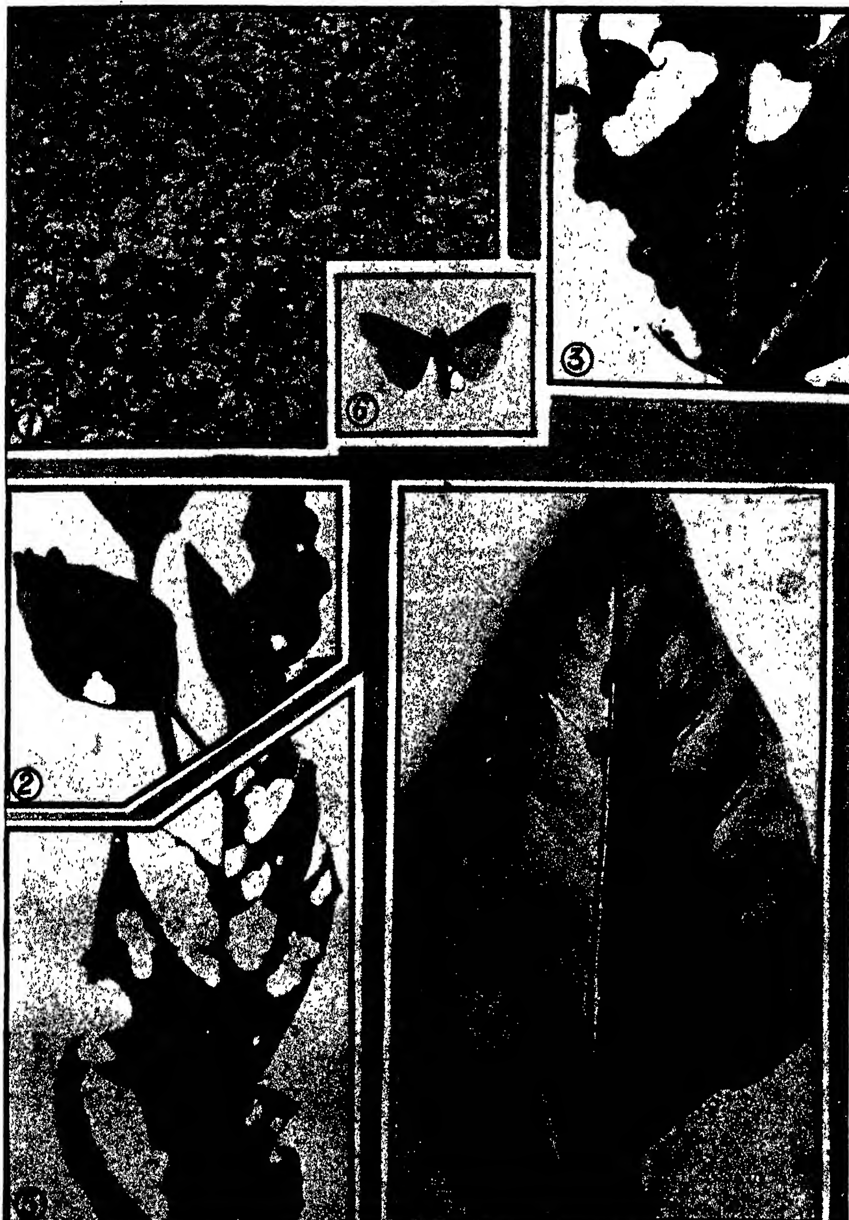


Plate CXXXVI.

The Pigweed Caterpillar (*Caradrina Exigua*).

Fig. 1.—Pigweed (*Amaranthus paniculatus*) eaten by caterpillars.
Fig. 2.—Caterpillars on pigweed ; natural size.
Fig. 3.—Caterpillars on a cotton leaf which they have eaten ; natural size.
Fig. 4.—Caterpillars on a tobacco leaf.
Fig. 5.—Caterpillars which died of a bacterial disease ; natural size.
Fig. 6.—Adult moth ; natural size.

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When the plant becomes larger the bugs have often been kept in check by the use of resin wash, or castor oil emulsion. Other contact insecticides such as paraffin emulsion would be equally

Plate CXXXII.

The Pigweed Caterpillar (*Caradrina Exigua*)

Fig 1 Pigweed (*Amaranthus paniculatus*) eaten by caterpillars
Fig 2—Caterpillars on pigweed natural size
Fig 3 —Caterpillars on a cotton leaf which they have eaten natural size
Fig 4 Caterpillars on a tobacco leaf
Fig 5 Caterpillars which died of a bacterial disease natural size
Fig 6 —Adult moth, natural size

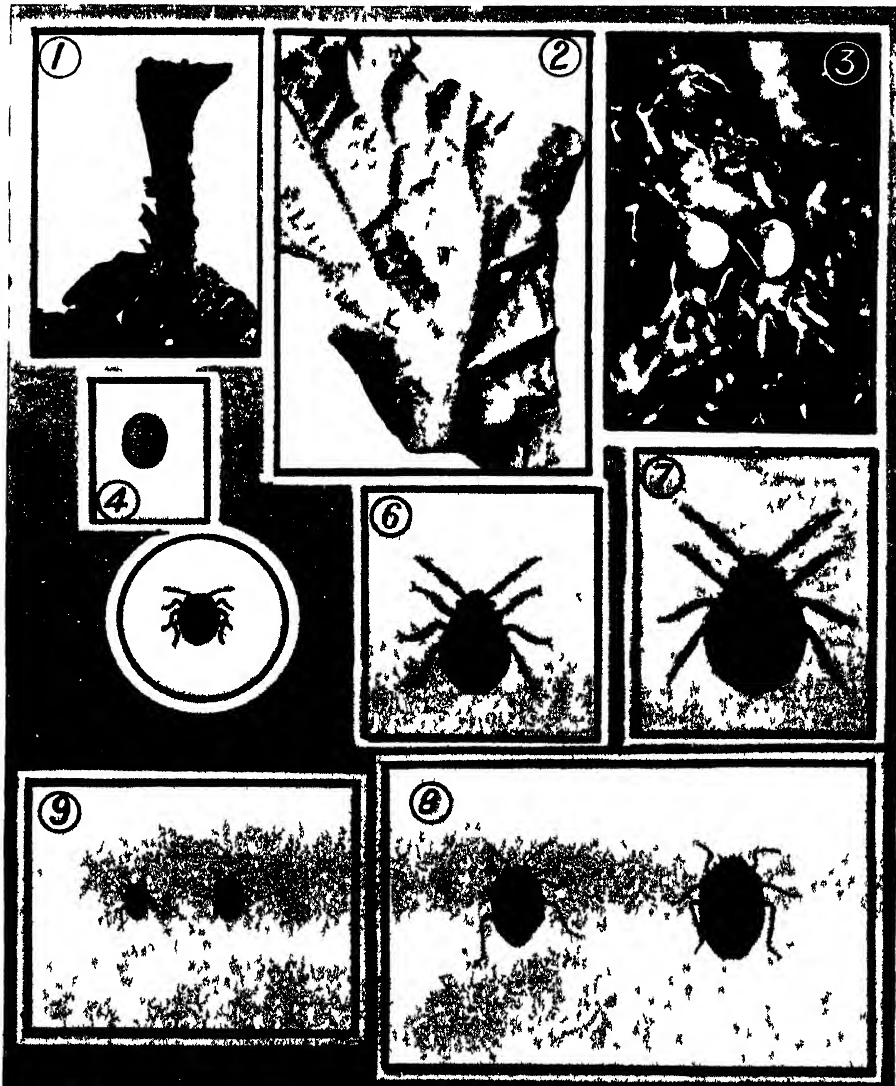


Plate CXXXVII

The Bagrada Bug (*Bagrada hilaris*)

Fig. 1. Eggs on base of radish leaf stem (inverted), natural size.
Fig. 2. Eggs on under side of old radish leaf, enlarged.
Fig. 3. Eggs greatly enlarged.
Fig. 4. Outline drawing of egg showing the lid.
Figs. 5, 6 and 7. Young stages or nymphs of the Bagrada, enlarged.
Fig. 8. Adult bugs, male on left and female on right, enlarged 2½ times.
Fig. 9. Adult bugs, natural size.

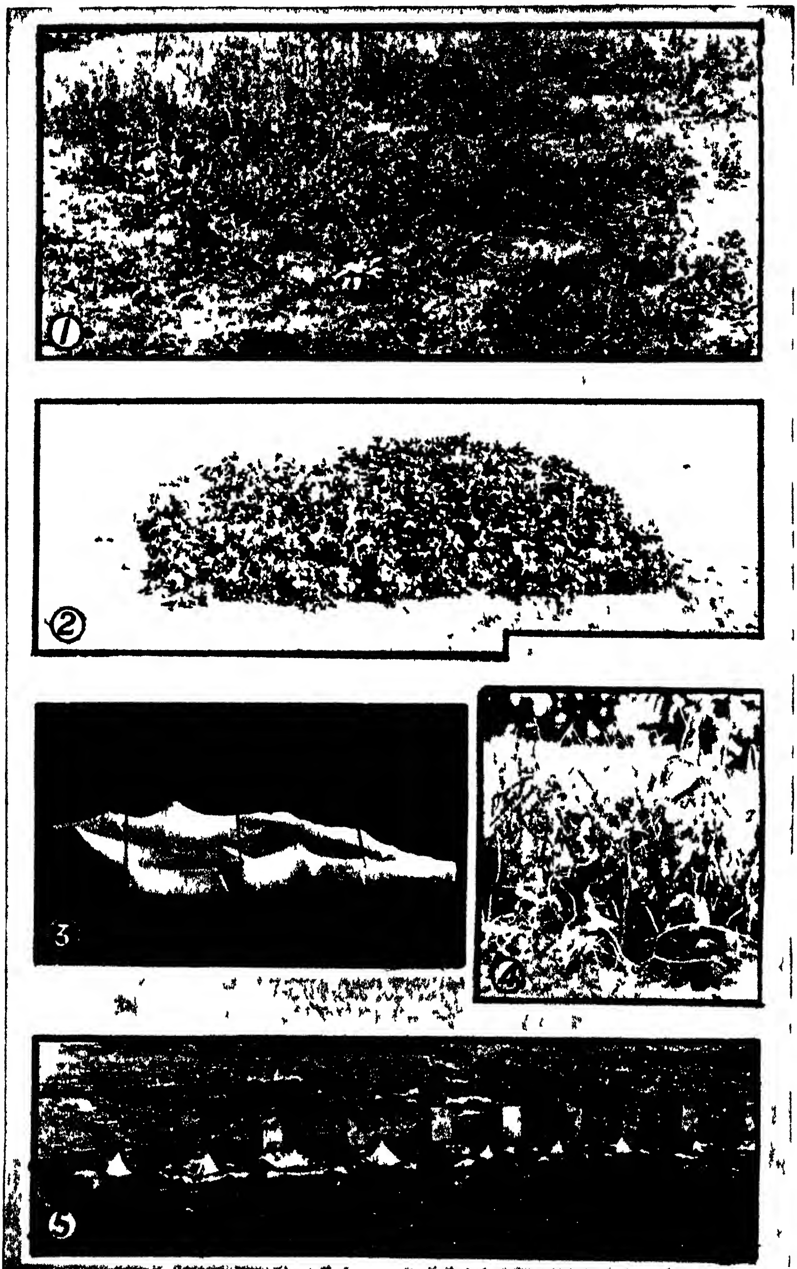


Plate CXXXVIII

The Bagrada Bug (*Bagrada hilaris*)

Fig. 1 Mustard killed by Bagrada Bugs
Fig. 2 Mustard grown under a cover so that bugs could not reach it
Fig. 3 Cover used to protect the above plot of mustard
Fig. 4 Nasturtiums killed by Bagrada Bugs
Fig. 5 — Tins and nets used to protect cabbage plants from the bugs. The tins are not as good as the nets

effective, but resin washes are the only ones which will stick well to the glossy leaves of the cabbage and cauliflower. The wash should be applied very thoroughly, and every part of the plant should be covered, in order that all the bugs may be reached, for it is only by contact with the spray that the insect is killed.

A valuable auxiliary in clearing a field of the bugs is a few fowls, providing that they do not take to eating and scratching up the plants. The fowls can be allowed to roam over the field, and in winter, when few insects are about, will greedily devour the bugs. In a small garden, where only a few flowering plants, or half a dozen cabbages, are troubled with the insects, hand picking is sufficient. The bugs can be shaken into a tin of water and paraffin, and thus destroyed.

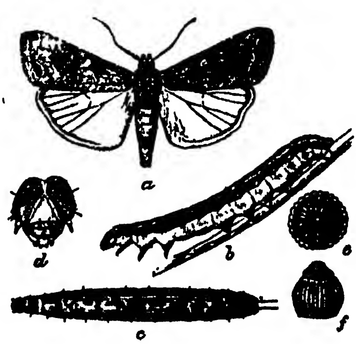
* * * *

THE PIGWEED CATERPILLAR.

(*Caradrina exigua.*)

By C. W. Howard, B.A., Assistant Entomologist.

During the past summer an insect appeared in the Transvaal, which, as a pest, was quite unknown before in South Africa, although its presence here was noted some years ago. The orchard connected with the Entomological Laboratory at Pretoria had become covered with "pigweed," or "*mist-brede*" (*Amaranthus paniculatus*), and early in January this pigweed was found to be badly eaten by small caterpillars. A little later, this caterpillar was found to be destroying tobacco, cotton, mealies, and many other plants in different parts of the Transvaal. For lack of a common name for the insect in South Africa, and because it was first found in such abundance on the pigweed, we have called it the "Pigweed Caterpillar."



Caradrina exigua: *a*, moth; *b*, larva, lateral view; *c*, larva, dorsal view: *d*, head of larva; *e*, egg, viewed from above; *f*, egg, from side—all enlarged. (From Bul. 57, U.S.A. Bureau of Entomology.)

Description and Life History.—These caterpillars were from ⅝ inch to 1¼ inches in length, of a slaty grey colour, with a lighter line

passing down the back, and a darker one on each side just above the spiracles, while below them was a yellowish band. The under parts were greenish, the head brown, and the shield on the dorsum of the first thoracic segment bore three whitish longitudinal stripes. There were several variations in colour, from very light dirty yellow, to almost black or brownish individuals.

Several of these larvæ were taken into the laboratory and placed in a breeding cage on January 10th. They pupated on the 11th, and adults emerged on the 22nd. Another lot brought in on the 18th pupated on the 20th, and adults emerged on February 1st. Still another lot pupated on January 23rd, and adults began to emerge on February 2nd. Thus the pupa stage varied from two to eleven days. Eggs were not obtained, so the length of the larval stage could not be determined. The pupa is brown, with the abdomen very dark, but the head and wings have a greenish tinge. It is about ½ inch in length, and has at the caudal extremity two long slender spines. A case is made in the soil where the larva transforms to the pupa.

The adult moth is a small, light grey, inconspicuous creature, which flies only at night, remaining concealed in grass and weeds during the day. The wing expanse is about 1¼ inches, or somewhat less. On the front wings, just before the centre and near the front margin, is a small, round, pale ochreous spot, and just beyond it, toward the tip of the wing, is a large, prominent, reniform spot, with ochreous or darker centre. Along the outer margin is a series of very small black spots. The hind wings are semi-hyaline, and of an opalescent white colour, with the veins and outer margin tinged with brown. The abdomen is dark brown, with a tuft of brownish hairs at the tip.

The number of generations of this insect in a season has not yet been determined. A single specimen was reared from a larva found on beets, towards the end of November last. The adults of this generation probably laid the eggs for the larvæ which appeared in January. No other larvæ were found during the summer about Pretoria, but larvæ were reported in the middle of February, and again in the last of February, so that probably three generations occur in a season.

Food Plants.—Only a few days after these caterpillars were discovered on the pigweed at Pretoria, reports came that they were doing a great deal of damage in the Waterberg District to tobacco, cotton and mealies. Upon investigation it was found that they were also eating several wild plants, among which were *Oxygonum sp.*, *Limeum viscosum*, and *Cleome monophylla*, var. *cordata.* An immense amount of damage was done to a tobacco plantation in that district. Near Pretoria, they were found eating young eucalyptus trees, grape vines and garden beets; from Piet Retief they were reported as feeding upon potato vines. The pigweed (*Amaranthus paniculatus*) seems to be its favourite wild food plant, probably because of its abundance, for it is the most abundant weed in the Transvaal, being especially common in neglected gardens, around cattle kraals and manure heaps. It is a native of tropical America, and has been

introduced from there to many parts of the world. In India it is cultivated for the seed, which is used as food.

Historical.—The history of this insect is of considerable interest. It is of almost universal distribution over the world, but seems to have originated somewhere in the Orient. Just where, I cannot say, owing to lack of literature. From there it seems to have spread westward throughout Europe, southward into Africa, and eastward into Asia. Hampson mentions it in his "Fauna of British India," Moths, vol. II., and again from Hawaii, in his "Fauna Hawaiiensis." From there it spread to the western coast of America, and is gradually advancing eastward over the American continent. The progress has been very slow; but at present it is known in middle and southern Europe, England, Mauritius, Madeira, Canary Islands, Africa, Asia Minor, China (?), Japan, India, Australia, Hawaiian Islands and U.S.A. west of the Mississippi Valley, although spreading eastward. It seems to be unable to survive very severe cold, so is found mostly in those countries which have mild winters.

In 1889 it appeared in Colorado, U.S.A., as a very great pest of sugar beets. Many hundreds of acres of beets were completely defoliated, and even the roots themselves partly devoured. For this reason, in the United States of America it is known as the "Beet Army-worm." In that region it was found that the moths laid their eggs from five to sixteen days after emergence, each female depositing about 350 eggs, which were placed in groups of twelve to fifty on the undersides of the leaves, each mass being coated with a downy secretion. In about four or five days the eggs hatched; larvæ were full grown and pupated in about 60 days. The pupa stage lasted 14 to 16 days. There were three generations, and the moths of the last one hibernated over winter. In Texas, where it appeared later as a pest on cotton, the life history more nearly approached what we found it to be in the Transvaal last summer; eggs hatched in three days: the larval period lasted 23 days, and the pupa stage about seven days; the complete life cycle was passed in about 40 days.

The insect has been carefully studied in the United States, both as a serious pest of sugar beets in Colorado, and a slight pest of cotton in Texas. Besides these host plants, it has been found upon potato vines, pears, apple trees, table beets, onions, maize, mallow (*Malva borealis*), lambs' quarters (*Chenopodium album*), pigweed (*Amaranthus retroflexus*), *Nicotiana glauca*, saltbush (*Atriplex*), wild sunflower (*Cleome sp.*), plantain, all plants closely related to beets, and many wild weeds and grasses. Like all the other army worms, to which it is closely related, it is liable to attack any form of vegetation, although it has never been krown to move in masses from one field to another, as is the habit of most army worms.

I was interested in comparing the above list of plants with the flora of the Transvaal, and found, with the assistance of the Government Botanist, the following plants occurring here, either native, introduced, or cultivated, which are closely related to, or the same, as those in the above list:—*Amaranthus paniculatus*,

Amaranthus spinosus, *Amaranthus thunbergii* (native in South Africa), *Chenopodium album*, *Malva parviflora*, *Nicotiana glauca*, *Plantago major*, *Plantago lanceolata*, *Cleome monophylla cordata*, wild grasses, and the following cultivated plants:—Mangels, beets, onions, potatoes, peas, apples, mealies, and salt bush (*Atriplex sp.*). Those upon which I have found the larvæ have been already mentioned. It will be interesting to find whether the remainder also are host plants in this country.

In spite of the universal presence of this insect, it has occurred in sufficient numbers to be a *serious* pest only in Colorado in 1899, and this past season in the Transvaal, while it has been present as a pest of cotton to only a slight extent for several years in the U.S.A. Our observations upon the insect last season seemed to indicate that in the Transvaal it will prove a pest during the dry seasons. It is always the small and stunted plants which suffer the most, and, in a wet summer, they would grow so vigorously as to successfully resist the attacks of the caterpillar without any artificial intervention.

Remedies.—Natural enemies seem to be very abundant. Large numbers of Tachina flies were bred from the larvæ, and a bacterial disease appeared about Pretoria, which carried off fully three-fourths of the larvæ. In tobacco fields where fowls were allowed to wander about, they almost exterminated the caterpillars.

In the way of artificial remedies, Paris Green was found very efficient. This can be applied to the affected plants either dry or mixed with water in a spray. To apply dry, the Paris Green should be mixed with flour or air-slaked lime, in the proportions of one pound of Paris Green to ten or twenty pounds of the lime or flour. The lime should be carefully sifted through a fine sieve before mixing, to insure its not being coarser than the Paris Green. The application can be made by placing the mixture in a coarse canvas bag, and sending a boy with one of these in each hand, or suspended from a rod over his shoulder, up and down the rows of tobacco or cotton. A slight jar will cause the contents to sift through the bag and over the plants. By using the two bags two rows of plants can be done at one time, and thus hasten the work. If the spray is preferred, it should be made by mixing one pound of Paris Green in each 200 gallons of water. To this must be added at least two pounds of freshly-slaked stone lime. If too little, no lime, or air-slaked lime is added, burning of the foliage might be the result. This solution should be applied with a spray pump, in a fine spray, so as to cover all parts of the plant with the solution.

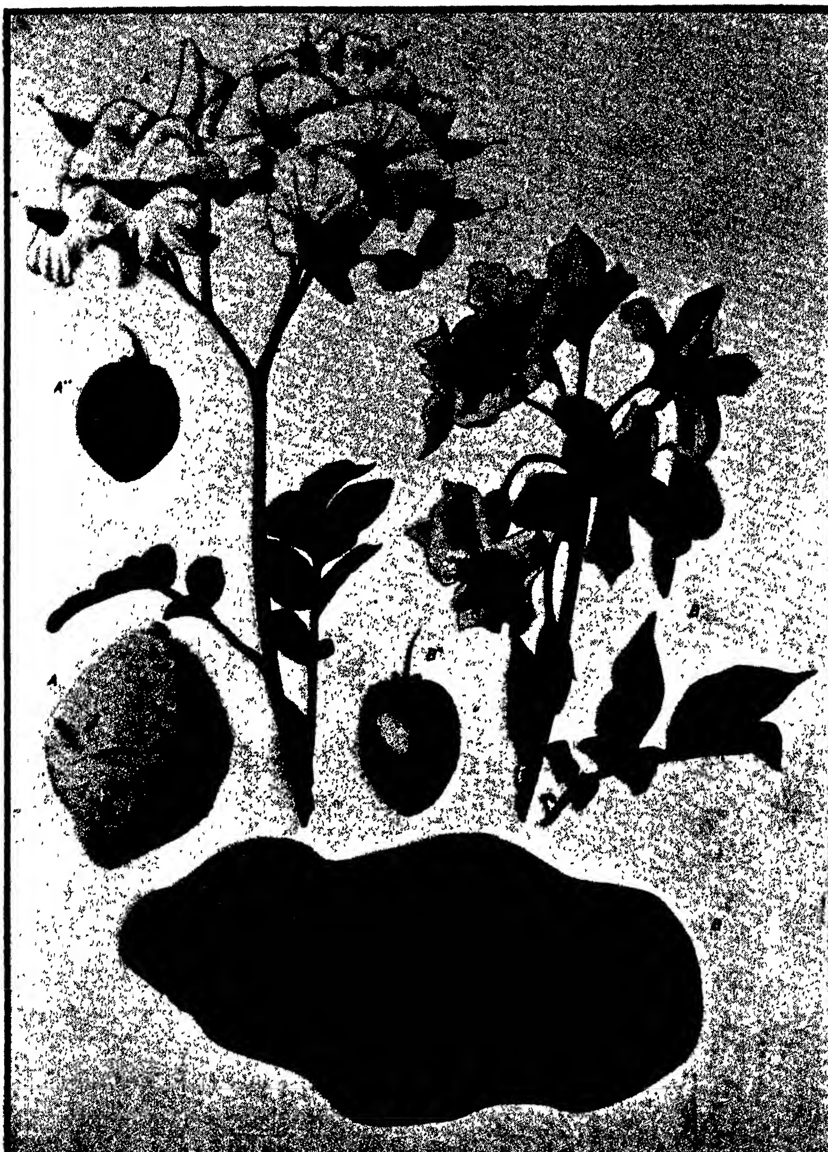


Plate CXXXIX.

Solanum Commersoni.

A A' A"—Tuber, flowers and fruit of the wild type.
B B' B"—Tuber, flowers and fruit of the violet variety.

(See Horticultural Section.)

THE HORTICULTURAL SECTION.

SOLANUM COMMERSONI VIOLET.

The following communication, with reference to the above-named new plant, has been courteously forwarded by Mr. S. M. Lewin, of Paris, through Messrs. Lewin Bros., of Capetown, together with a small sample box of tubers for experimental purposes in the Transvaal. The latter have been forwarded to the Manager of the Government Experimental Farm, Potchefstroom, and the Assistant Horticulturist, Government Experimental Orchard, Ermelo, for testing purposes.

Apart from the scientific point of view, which alone is of much interest, it is hoped that the experiments conducted here may prove that the tuber is likely to be of some practical utility in bringing under cultivation lands at present considered unfit for use. As a matter of course, full reports of the behaviour of the tuber will be published in this Journal.—R. A. Davis, Horticulturist.

Abstract of communications to the Scientific Bodies of France by Mr. Labergerie, the discoverer of the new tuber.

Mr. Labergerie, the discoverer of the *Solanum commersoni violet*, writes in the "Journal de l'Agriculture Pratique" that for the last three years the agricultural and scientific world has been interested by the experimental work and the trials made at Verrieres (France), with the object of the transformation of the *Solanum commersoni violet* into an eatable potato. As the question seems far enough advanced at the present moment, we shall now relate, briefly and succinctly, what has been done during five years of great efforts and patient researches.

The *Solanum commersoni* is a wild plant, which originally comes from South America, its favourite habitat being the moist shores of the Mercedes River, where Commerson discovered it near Monte Video (Uruguay) in 1767. Its description by Dunal, and more recently by Heckel, is similar to that given by Hériot in 1584, when he described the aspect of the plant which he brought with him from Virginia, and which appears to be the origin of the potatoes acclimatized in England.

In 1896, Mr. Heckel was informed by Mr. de St. Quentin of the curious observation made in Uruguay, by one of his relatives, upon the mutability of a wild plant with tubers, found on the shores of the Mercedes River. Convinced long ago that our European potato, *Solanum tuberosum*, must either wholly or partly come from the *Solanum commersoni*, Mr. Heckel, with the assistance of Mr. de St. Quentin and of Mr. de Robido (Consul for Uruguay at Marseilles),

was enabled to present to the Botanical Gardens of that French sea port a wild plant possessing tubers, which, by the comparison and description of Dunal, was shown to be undoubtedly the *Solanum commersoni*. By a selected method of cultivation, Mr. Heckel obtained an appreciable amelioration of the tubers, but without a radical transformation.

In 1901, the mere chance reading of an agricultural paper brought Mr. Labergerie to ask Mr. Heckel for a few tubers of the new plant. The samples forwarded had rather a suspicious look about them. However, following the instructions given for their cultivation, they were placed in a very cool and fertile soil, and all the plants came on well, showing a goodly spread, but weak vegetation, with leaves slightly rounded, and odoriferous flowers. But one plant attracted attention by a stem rather thicker and more rigid, and soon at the foot of that plant the earth was noticed to burst open, and violet tubers of a bitter taste and slightly scented were apparent. The other plants remained identical with those of the *Solanum commersoni*. Mr. Labergerie put aside these tubers, or rather what was left of them after the damage caused by the rodents, and also after a number of accidents had reduced their number to three plants in 1902, which seemed to resemble very much the *Solanum commersoni* of Europe.

In 1903, the preceding year's crop was replanted with care, and the results were so satisfactory that upon the advice of Messrs. Heckel and Schribaux, two French scientists, the question was brought before the Board of the National Society of Agriculture of France. These first results can be described as follows:—Fabulous output computed at 103,000 kilogrammes, equal to 208,000 English pounds, to the hectare of 2½ acres, and complete resistance to the *Phytophtora infestans* or potato disease—such was the first balance sheet of the *Solanum commersoni violet.*

Meanwhile the primitive type of the *Solanum commersoni* was thickening its tubers and shortening its creeping membranes, and thus gave two new yellow varieties, with leaves and stems still identical with those of the type, but with tubers quite smooth, and of a fairly bitter taste. In the spring of 1904, experiments were again made with more method and success. The first remarks, and the advice of Messrs. Schribaux, Heckel, Grandeau, and Gaston Bonnier, enabled Mr. Labergerie to avoid the hesitation of his first trials.

In the autumn of 1904, it was possible to record as to the violet variety found first, a dozen new varieties, and with respect to the two varieties found in 1903, another four varieties. The primitive type showed very clearly new tendencies to transform itself, and a new variety appeared with tubers of a yellow colour, with violet eyes under one white tuber. The result of the rooting-up of the violet variety entirely confirmed the hopes entertained during the year 1903, and notwithstanding the havoc played by the rodents, and the rather late planting with small plants, Mr. Labergerie was able to gauge the output at between 22,000 lbs. in very dry soils, and 198,000 lbs. in

very damp ones, per hectare of 2½ acres. In average, cool soil of moderate quality, the output was equivalent to 110,000 lbs. to the hectare. The presence of Messrs. Schribaux and Heckel, who had visited Mr. Labergerie's potato fields at Verrieres and witnessed the various transformations of the *Solanum commersoni,* caused a communication to be made to the Academy of Sciences of France, that an average output of 138,600 lbs. per hectare of 2½ acres had been obtained.

The transformation of the violet variety was complete in outward resemblance to the *Solanum tuberosum* of the European cultivation, but it showed very particular characters. The creeping membranes, which that variety had inherited from the primitive type, gradually disappeared, and were only noticeable, with some abundance, in very dry soils. In very moist soils, these membranes were only kept by a few rare plants, but a very long creeper was noticed under one unique plant, which gave one of the most curious varieties, of which mention will be made later on. The violet variety had a weak tuber bearing aerial stems in 1902, but the following year aerial tubers, weighing about ½ lb., were noticed; in 1904 they had reached a weight of 1¼ lbs. to 1½ lbs. and even 2 lbs.; and their number was such that it represented, for certain fields, the ninth part of the crop. The extraordinary display of aerial tubers is one of the most marked characteristics of the plant, which distinguishes it immediately from the varieties of the common *solanum tuberosum,* as cultivated in Europe, which very seldom bears any aerial tubers, and then only of an insignificant weight, with a maximum of not more than 1½ to 2 ozs. The plant presented, also, other particular characters—the emerging of the subterranean tubers, and a formation of the same tubers almost on the surface of the ground. Lastly, upon the same plant were found: first, a violet underground tuber; secondly, a yellow one, and one half yellow and half violet. One plant had returned to the primitive type of the *Solanum commersoni,* and at the same period Mr. Heckel himself witnessed a return, through the aerial vegetation, of a plant of the primitive type from a tuber of the violet variety as it was cultivated at Verrieres. Again, several plants gave simultaneously violet tubers and also tubers of a mixed violet and yellow colour, or red and white, or yellow with red eyes. The violet variety retained its complete immunity against the *Phytophtora infestans,* notwithstanding the vicinity of the diseased potatoes.

The flavour of the tubers, without an after taste or bitter taste, recalled that of potatoes of good quality, but with a slight perfume, and with two peculiarities, viz., no bitterness in the greenish parts, and an absolutely neutral taste in the cooked tubers. The two varieties which appeared in 1903, loosened themselves, one keeping long, creeping membranes, and giving a sub-variety with fine tubers, the other having lost its creepers, but giving from its two sub-varieties tubers of different shapes and colouring. The primitive type in poor soils returned to its original aspect, and on the contrary in very fertile and moist soils it thickened its tubers and lost its creeping membranes,

meanwhile losing some of its bitterness. The experiments of Mr. Coudon, at the laboratory of the Agronomical Institute, showed that the violet variety was of an average richness in starch, and that it had lost all trace of solanine, still very abundant in the primitive type of the *Solanum commersoni.*

All the above statements made one augur well of the new plants. The crop of 1905 was soon to confirm these expectations. That year's planting was methodically undertaken, and it was possible in the autumn to deduce from acquired results confirmation of the aptitudes of the new plants. The type of the *Solanum commersoni,* reaped in fertile ground and already much improved, was planted in poor and in very slightly fertile soils of different kinds. Everywhere it lost the majority of acquired improvements. Quite the contrary happened when planted in very fertile soils of different kinds. The transformation was so noticeable, that in the lots planted in these soils, one finds tubers with a smooth skin, without lentils, and with hardly any bitter taste. A wild tuber, which was transformed in 1904, gave a yellow one with violet eyes, and an almost identical vegetation with that of the *Solanum tuberosum,* and similar to that of the first violet variety of 1901. This last one has confirmed all its qualities. The flavour is refined, and it can advantageously be compared with the ordinary potatoes of daily consumption, whilst it is superior in quality to the potatoes of the varieties extensively cultivated. It has, as in 1904, largely tuberised its aerial stems, and notwithstanding the unfavourable weather of the autumn, Mr. Bussard was able to gather aerial tubers of 1 lb., with aggregate weights of 2½ lbs. per plant. It is well to observe this continuation in the formation of aerial tubers, because it constitutes one of the characteristics of the plant. Several experimentalists have also noticed thick aerial tubers in great numbers, particularly Mr. André, who has found almost 2 lbs. of them in a single plant. The creeping membranes have decreased, and it is only exceptionally that a few were noticed of a length of 20 inches. The tubers continued to form themselves in agglomerating round the stem at its foot, and emerged very strongly from the soil.

The resistance to the frost, which was noticed in 1903, has been maintained up to 28.4 F. for the stems, and up to 24.8 F. for the tubers. Several lots have resisted still severer cold, and it is hoped at Verrieres that selected plants will be able to stand yet a lower temperature.

The resistance to the disease was absolute on all the experimental fields in France, and that in most remarkable conditions—amongst potato fields infested with the *Phytophtora infestans.* This immunity was complete in the vicinity of the "Blue Giant" (a variety of potatoes), which suffered from the disease, and also in the cultivation of Messrs. Cathelineau, Chevalier, the Agricultural School of Grignon, etc. The resistance was such that Mr. Delacroix, Director of the Institute of Vegetable Pathology, tried five successive times, but without success, to infect the plants, which resisted these

intentional infections as completely as they resisted the infection of the *Solanum tuberosum* which had contracted the disease in the Institute's garden.

The richness in starch has increased on that of the preceding years, according to the statements made at Verrieres, where, since the appearance of the violet variety, the proportion has successively increased from 11 per cent. to 14 per cent., then to 15 per cent., and ultimately to 16 and 17 per cent., and even more for certain lots of tubers. In this respect, the *Solanum commersoni violet* is equal and even superior to the great bearing varieties of the *Solanum tuberosum* of our cultivation, and the other varieties of the *Solanum commersoni* have, it seems, a weak proportion of starch, which, however, increases as the plant developes, and becomes gradually similar to that of the wild type, which possesses a considerable proportion of starch.

There remains to be recorded the output of 1905. The rooting-up of that season, Mr. Bussard says, has given a crop varying between 53,900 lbs. and 86,900 lbs. per hectare of 2½ acres, according to the moisture of the soil; and in moister soil Mr. Bussard has recorded weights of 4½ to 15 lbs. per single plant. All these figures correspond to such outputs per hectare that it is better not to mention them, for fear of falling into exaggeration. This statement is confirmed by men who have, more or less, privately obtained such results; for instance, Mr. Vincey, at Asnieres, 4½ lbs. per plant; Mr. Marteau, at Wagonville, 6½ lbs. per plant; Mr. André, at Lacroix Bliré, from 7 to 15 lbs.; Mr. Blaringhem, in the Pas-de-Calais, 7 lbs.; Mr. Fleury, in Loire et Cher, 7 and 9 lbs.; Mr. Cathelineau, in Maine et Loire, 7 lbs. per plant. These various results have all been acquired in very cool soils with rather late planting. The output is inferior when the tuber is planted early in dry and cool soils only.

All these experiments and examinations show that it will be unwise to estimate the highest expected output of the *Solanum commersoni violet*, because one would certainly either underestimate or exaggerate them. But what must be concluded from all these indications is that we are in the presence of a new plant, which surpasses by far the largest output of our European potatoes. Wherever the *Solanum commersoni violet* has been compared with the *Solanum tuberosum* of our cultivation, even in dry soils, its output has been superior in considerable, and often in remarkable, proportions of from 30 to 100 per cent.

As was to be expected, a discovery of this importance could not fail to create contradictions, and not always kindly appreciations. One of the forms of criticism which was attempted between the *Solanum commersoni violet* and the "Blue Giant," was the classification of both varieties as identical. Without insisting upon the differences of details—(vegetation, leaves, flowers, shape and colour of the tubers, etc., etc.)—which were remarked in abundance by scientists such as Messrs. Bonnier, Marteau, Blaringhem, Cathelineau, Colomb, Pradel, and others, it is interesting to note, as striking differences, the much larger production of tubers of the *Solanum commersoni*

violet than of the "Blue Giant," and everywhere, without exception, the complete resistance of the *Solanum commersoni violet* to the *Phytophtora infestans*, which is absolutely *nil* in the "Blue Giant." But the difference is more striking yet, for never has the "Blue Giant" tuberised its aerial stems in the proportion that the *Solanum commersoni* has tuberised its own. Furthermore, the fruits of the *Solanum commersoni violet* are not spherical, but pointed, as those of the wild type, and when they appear like the spherical fruits of our potatoes they bear a characteristic little furrow. Besides,. the *Solanum commersoni violet* has given numerous examples of a tendency to return to the primitive state, both at Mr. Heckel's and at Verrieres plantation, and these returns are more or less complete, and affect sometimes the stems and leaves, as at Mr. Heckel's; at other times the tubers, as at Verrieres, or at Mr. Vincey's. The *Solanum commersoni violet* has given, in 1904-5, a series of identical varieties with those issued directly by the primitive type, or similar to the descendants of these varieties, and, strangely enough, all these variations display again creeping membranes, while the well-fixed violet variety does not, so to say, possess any, and bears cordiform fruits. All these reasons do not allow any doubt to exist as to the absolutely authentic origin of the variations obtained at Verrieres; so much so, that Mr. Nanot has himself witnessed the beginning of a transformation of the *Solanum commersoni* on his property of Aix s/ Vienne, and of the same order as that commenced at Verrieres.

Besides the violet variety of the *Solanum commersoni*, thirty other varieties issued either directly from the wild type, or from the violet variety, and each of those varieties seems to be dividing itself into two or more others. They are as yet, with the exception of two or three, very badly fixed, as stated by Mr. Bussard. A few of those varieties seem to have, like the violet variety, a marked preference for moist soils; some of them promise to become very rich in starch, others to offer a complete resistance to the potato disease, as is the case with the first violet variety. Some of these varieties give a wonderful vegetation, similar to that of the violet variety, and have stems reaching a length of 80 and 120 inches. Others, again, have stems and leaves similar to those of the primitive type. All the above lead us to the practical conclusion that Mr. Heckel's work and the Verreires experiments have endowed agriculture with new plants which promise to give extremely interesting results for the alimentation of man, for the fattening of animals, and for industries where large quantities of starch are wanted.

The first of these plants, the *Solanum commersoni violet*, by its adaptation to moist soils where no alimentary plant grows, and by its great output and good qualities, can at present be considered as particularly suited to be made use of in regions hitherto absolutely useless. Special mention might here be made of the great boon the introduction of such a plant would be for South Africa, where such vast tracts of land lie useless, and therefore worthless. From the scientific point of view, it seems that the veil which has covered so

long the origin of the potato is on the point of being completely lifted, and this is not one of the least interesting sides of the question submitted to the scrutiny of learned men.

* * * *

No 2.]

IMPORTED PEACH TREES.

One of the questions most frequently asked in connection with peach growing in this Colony is, "why do not my imported peach trees bear fruit?" and the next remark generally is, "my trees are growing splendidly, and looking perfectly healthy, but I hardly ever see a peach on them." The complaint is not confined to any one section, but is general in all parts of the Transvaal. It is a fact, and an unpleasant fact, that there is a great deal of cause for dissatisfaction. This failure to fruit is rendered more unpalatable when old recognised Transvaal varieties, standing, perhaps, in the same orchard, are literally covered with fruit year after year. More than likely no attention has been paid to the latter, no cultivation or pruning has ever been indulged in, possibly no water given, yet in spite of all these drawbacks the crop appears with the utmost regularity. No wonder then that people are beginning to cry out that the imported peach is "no good."

It is understood, of course, that the term "imported peach" applies to varieties brought originally from oversea but propagated for some years past in the different coast Colonies. Now, with all due respect, the writer states that, so far from being "no good," the varieties of peaches usually alluded to under this heading rank amongst the finest productions of the different countries from which they came originally. No finer yellow peach exists than the "Early Crawford," or white than the "Hales Early," yet the extremely shy bearing of these kinds in the Transvaal generally, it must be confessed, up to the present has caused them to be looked upon with disfavour here.

Such standard varieties as Briggs May, Early Alexander, Foster, Gladstone, Mary's Choice, Muir, Salway, and Sea Eagle bear a reputation for regular and prolific bearing, both in Europe and America, which is indisputable. True, possibly one or two varieties of those named may do well in one part of the country and one or two in another, but even at the best, the regular bearing qualities of our own peaches, which may be termed indigenous, are so far in advance of the best of these as to cause them to be regarded with distrust.

The question as to the cause of these imported peaches refusing to bear has often been discussed, and many and various reasons assigned to account for the shortcoming. Amongst others, the stock on which the trees were worked has been held answerable, and one prominent nurseryman has assured the writer that the substitution of stocks grown from our common yellow peach has done much to remedy the trouble. I regret that from my own observation I am unable to

confirm this statement. A further contention—that the fruiting of these trees has been prevented by the use of stocks grown in France, and unsuitable for South Africa—is disposed of by stating that for some years the import of peach stocks from France has been prohibited, both in Cape Colony and the Transvaal. In both cases it will be observed that the stock has been blamed as the cause of non-fruiting. No notice has been apparently taken of the different climatic conditions, altitude, etc., existing here and in the countries which have originated these peach varieties. This is a matter which should undoubtedly have received consideration. Primarily the opposition of the seasons existing in the northern and southern hemispheres might have received some notice, although in Australia no marked effects from this cause have been noted. Principally the difference in atmospheric conditions should have been considered. In any case, whatever the cause may be, the fact stands out that certain sorts of peaches have not, and apparently will not, fruit in the Transvaal. That amongst these are some of the very best is well known.

It remains for us to make use of those imported kinds which have proved a success as far as fruiting is concerned, and which in themselves have proved commercially useful. The number of these is not as small as supposed, and lists of them are given. The most prolific and regular bearers are undoubtedly those of Chinese origin, and these may be grown with much success in those parts of the Transvaal in which, hitherto, the production of good peaches has been deemed impossible. Amongst these may be mentioned, Peen to, Waldo, Angel, and Florida Crawford. Pretoria, Waterberg, Rustenburg, Marico, Piet Retief, in addition to Barberton, Lydenburg, and the Zoutpansberg districts, are all well suited for these kinds of peaches. For parts of the Colony such as Christiana, Potchefstroom, Krugersdorp, Witwatersrand, Lichtenburg and Heidelberg, the following kinds will be found good:—Pallas, Elberta, and Dr. Hogg. The best peaches for the eastern high veld have yet to be decided on; the cold conditions so often experienced there in spring time preclude, to a large extent, the use of early flowering kinds, and it is quite possible that some time will elapse before varieties will be selected which will be entirely suitable for commercial growth in that district. Those kinds mentioned as being suitable for the hottest districts are not desirable for colder climates on account of the extremely early date at which blossoming occurs. Peen to commences to flower at the end of June, or the beginning of July, ripening its fruit late in October or early in November. Angel and Waldo are a little later—about 21 days as a rule—whilst Florida Crawford is a little behind these. It will be readily seen that in such a district as Heidelberg, for instance, serious danger would occur from frost injury both to blossoms and fruit. Therefore later blooming and fruiting kinds are recommended for the colder parts of the Colony.

It may not be out of place to mention some of the features and history of the peach varieties recommended here. The Peen to, or

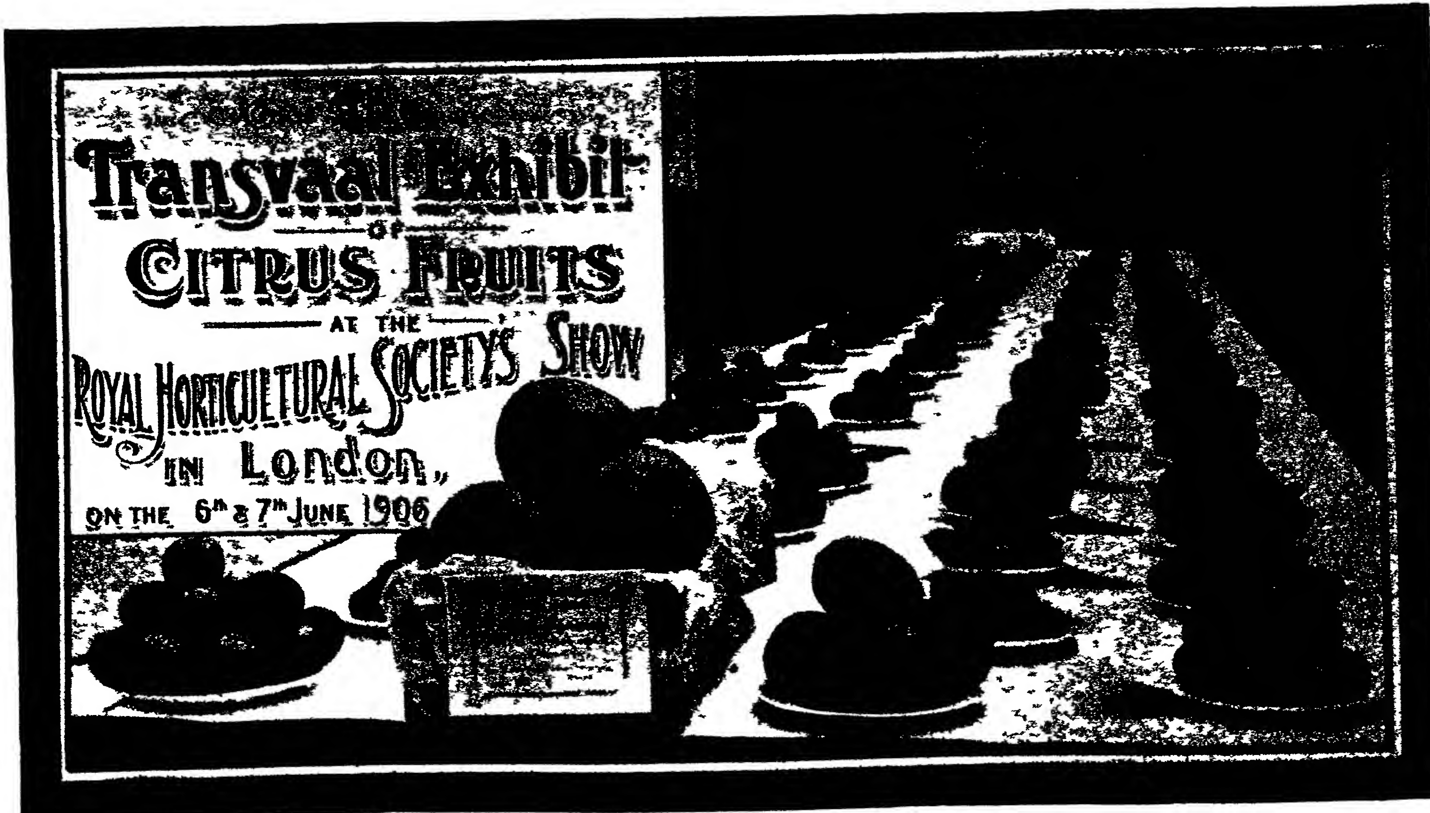

Transvaal Exhibit
OF
CITRUS FRUITS
AT THE
ROYAL HORTICULTURAL SOCIETY'S SHOW
IN London,
ON THE 6th & 7th JUNE 1906

Plate CXL

flat peach of China, is of peculiar shape and appearance, being more the shape of a tomato than a peach. In addition, it has an "eye" somewhat similar to that of the *calyx* of an apple. The flavour is good, the flesh sweet and melting, and preferable to the well-known "November" peach. It is the earliest good peach.

Waldo is a seedling grown from the pit of the Peen to. No greater variation exists between parent and offspring than is apparent here. The Waldo, instear of being flat and compressed, is extended in the opposite direction, having a long "nose" a little curved, flesh creamy, and quality generally leaving nothing to be desired.

Angel is another seedling of Peen to, ripening shortly after Waldo, free stone, as both these before named. White flesh of good quality and flavour.

Florida Crawford bears some resemblance to theYellow Crawford, its parent. It is not, however, quite the same in flavour, but has the merit of being better suited to our climate. Flesh yellow, free stone, a good eating and canning peach. This, as well as the Waldo and Angel, was first raised in Florida, U.S.A.

The Pallas, mentioned as being best suited to the cooler districts, is also a Florida production, blossoming in September and ripening in January. This is also a first-class peach.

Elberta is best of all the imported peaches, leaving nothing to be desired as to size, quality, flavour and colouring. It is a cross between Yellow Crawford and Chinese Cling, but favours the former of its parents, which it much resembles. With firm yet melting yellow flesh, free stone and fine flavour, this peach may be said to be easily first on the list of our available varieties. The shape, size, and colour leave nothing to be desired.

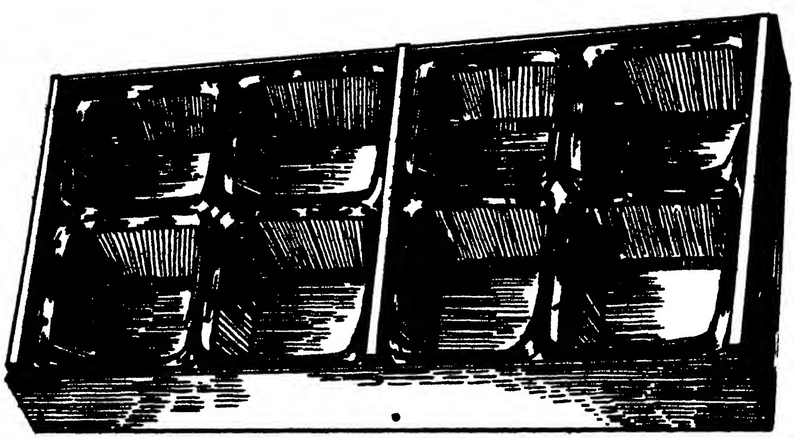
Dr. Hogg is of English origin, and has proved one of the best peaches for the districts named.

A further remark with regard to those kinds of imported peaches which have not adapted themselves to our conditions is that the writer, though not directly responsible for their introduction to this continent, was entirely of opinion that they would do well here. When Mr. Pickstone, of Cape Colony, (who has done so much for fruit culture in South Africa), spoke of the kinds of peaches he intended bringing over from California to that Colony, now some 13 years since, he named the varieties he intended to bring, and they were one and all commended. It is unfortunate that they have not realised anticipations. Before closing, I would ask all growers of the classes of peaches named to do a little experimental work on their own account. The success attained in the successful raising of good varieties from seed in Florida is not impossible in the Transvaal, with the additional prospect of affording our growers the benefit of securing a peach entirely acclimatised and adapted to our peculiar conditions. Such work proceeds in the Government experimental orchards, in addition to systematic crossing of approved kinds. Is there not some individual who wants the credit of doing useful work and beating the Agricultural Department in the race for peaches perfectly suited to all our varied conditions?

No. 3.]

FRUIT BOXES.

The custom of packing fruit carefully in boxes for the markets is steadily advancing. This is one of the most satisfactory features in connection with the fruit growing industry. It shows that the continued efforts of this Division to inaugurate a thorough system of putting up all our fruits in clean, attractive packages of uniform size and appearance have not been without some effect. With the development of our new railway systems, a revolution in the methods hitherto employed in sending oranges to market must come. To forward consignments of citrus fruit to the market agents in sacks per rail would probably result in great disappointment to the shipper. There is only one correct method of packing oranges for market, and that is, to use a standard-sized box. This box should be used by every owner of an orange grove; in time the custom of quoting the price of oranges by the 100 must give way to quotations per box.



The accompanying cut shows a package expressly constructed for carrying strawberries. It measures 3 x 11 x 23 inches complete, and contains eight punnets, each of which holds about 1 lb. of fruit.

I am informed by Messrs. Mosenthal Bros., Ltd., of Pretoria, that they have determined to carry a stock of the most useful sizes in fruit boxes, and they have selected the following:—

2 x 9 x 15 for apricots and plums,
2½ x 12 x 18 for apricots and peaches,
5 x 12 x 18 for pears,

together with "standard" orange boxes.

It may be of general interest to know that the standard box mentioned contains a carrying space of just upon two cubic feet. The measurements are 11½ x 11½ x 26 inches, and boxes of this size contain a "pack" of 112, 150, 176, 200, depending upon the size of the fruits.

PRUNING OF FRUIT TREES.

It is a matter of constant regret to the writer that he has not been able hitherto to produce a bulletin which should deal exclusively with this subject. A few scattered notes are all that it has been possible to offer. The primary cause of the delay in the production of such a treatise has been a desire to acquire a more thorough knowledge of the conditions of growth in the Transvaal. Such pruning as is generally adopted in Cape Colony, for instance, is not suitable here in its entirety. Neither can systems in vogue in California be regarded as entirely acceptable. The time has nearly arrived, however, when something definite can be stated as to which are the best methods to be adopted for the successful pruning of certain kinds of trees.

The accompanying photographs are reproduced in order to afford some idea with regard to the best method of pruning both apricot and peach trees in the third year of growth. Plate CXLI., Fig 1, shows an apricot tree (Blenheim variety) as found standing in the orchard of Mr. V. Robertson, Rolfontein, District Wakkerstroom. This was planted in July, 1904, pruned in July, 1905, leaving three main branches which go to form the main support of the future head. It will be observed that a very vigorous growth followed this pruning, and that it has been necessary to adopt the practice of summer pruning. The effect of this treatment can be seen in the more sturdy appearance of those branches which have been topped, in comparison with those which escaped that operation.

In Fig. 2 of the same Plate the same tree is shown with by far the greater portion of the previous year's growth lying on the ground. It is now reduced to a good working basis for the support of the superstructure which in a few years will be added to its height. The superfluous branches are removed; they would have only interfered with one another, and, as further growth occurred, aided materially the drain on the root system. Any fruit borne on these branches would only have been of inferior size. As this tree is left, the roots have full play to support the reduced head, with the result that a correspondingly vigorous growth will take place during the coming season. These same roots, it will be seen, have now to support less than half the natural growth. Had the tree remained unpruned, the result would have been a mass of branches struggling for light and air, and, moreover, each engaged in assimilating the sap pumped up from below. Under such conditions really fine fruit is out of the question. Apart from the bad effect caused by the darkening of the interior of the tree, the multitude of branches would each have been engaged in practically a fight for life. Under these circumstances a curtailed growth naturally occurs, from which follows a large crop of small and inferior fruit, and fruit of that stamp does not pay to grow. There is too much of it on our markets, where it only realises a low figure, whilst such as would be produced on the tree, as shown after pruning, will—although, perhaps, far less in number—more than equal

the weight obtained under unpruned conditions, and realise more money.

Plate CXLII., Figs. 1 and 2, shows a peach tree of a similar age before and after pruning. The interior branches have been removed, and all non-bearing laterals also. The trunk, main and secondary branches are left well defined, and give some idea as to correct pruning of this stamp of tree. Note that the laterals on the wood of last year's growth are left largely untouched. The season's crop should be borne on these, and, given fair climatic conditions, the crop should need thinning. It will be interesting to follow up the development of these trees, and, if possible, pictures of the same specimens will be secured for illustrating the coming season's growth.

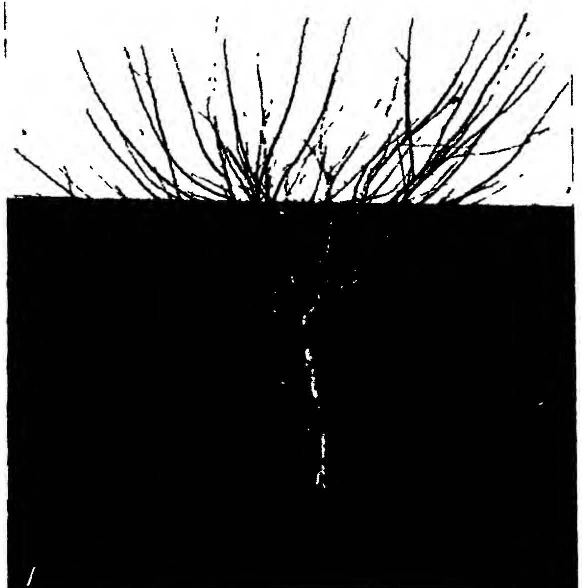
It may be added that the individual trees given were not specially selected as showing absolute perfection of style of growth, but taken in a somewhat haphazard way from an orchard containing many hundreds of trees, all treated in a more or less similar manner.

* * * *

DISTRIBUTION OF VEGETABLE SEEDS ON A CO-OPERATIVE BASIS.

It has been decided that the issues of vegetable seeds hitherto made by this Department must now cease. Several different considerations have combined to lead up to this decision, amongst the most important being the undoubted interference which the free issue of seeds caused with the legitimate business carried on by seedsmen, who have made investments of capital, and endeavoured in every way to promote the interests of their customers. Conditions are now very different from when the policy of issuing garden seeds was initiated. Those engaged in this business have generally adopted a go-ahead policy, and in some instances conduct in person a definite testing of all the seeds they supply, discarding all those which are not entirely reliable. It has been also found that they have availed themselves largely of the information obtained as the result of co-operative experiments in securing seeds of those varieties which have proved to be suitable for growth in different parts of the Colony. Such being the case, it is felt that the necessity for a Government Department to deal in vegetable seeds no longer exists.

In order, however, that no new variety of value appearing either in South Africa or in any other part of the world may be lost sight of, it is intended to introduce such, as they appear, for testing purposes only, on the horticultural experimental stations in different parts of the Colony, and the results of these tests will be published for general information.



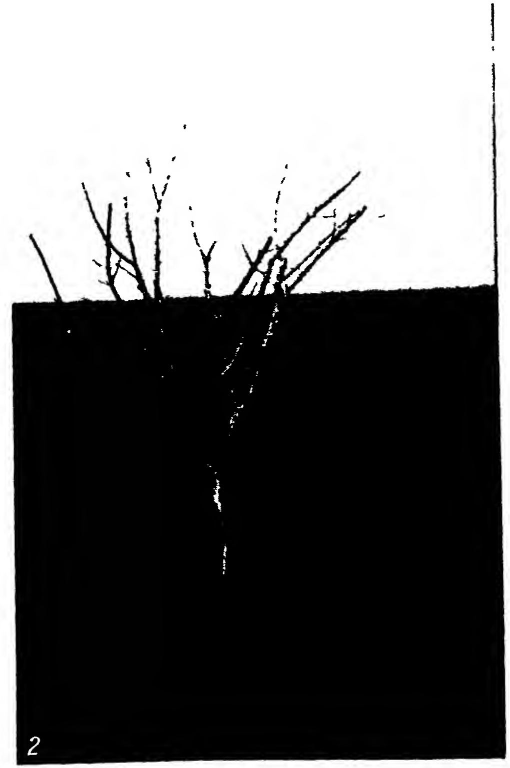


Plate CXLI.

Three Year Old Apricot Tree.

Fig. 1.—Before pruning

Fig. 2.—After pruning.

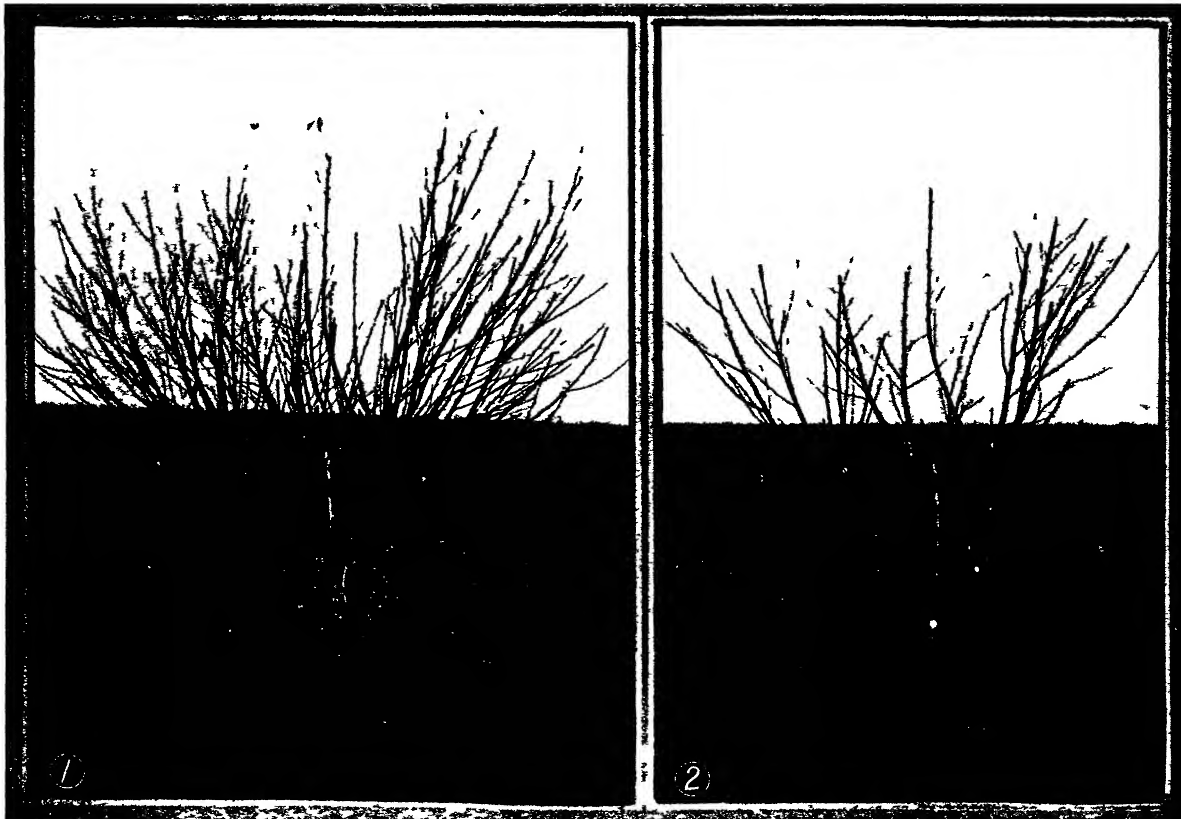


Plate CXLII

Three Year Old Peach Tree.

Fig. 1. Before pruning. Fig. 2. After pruning.

THE POULTRY SECTION.

TABLE POULTRY.

By R. Bourlay, Poultry Expert.

There is no section of poultry keeping which leaves room for greater improvement in this Colony than that of table poultry. A survey of the fowls sold on the morning markets in any town in the Transvaal or of those offered for sale by the local butchers is sufficient to convince anyone of this. It is rather surprising that no private efforts have been made in this direction, for there can be no doubt that there is a good opening, and the producer of really good table birds would have little difficulty in finding a ready sale for his produce; in fact it is more than probable that when the superior quality of a well-fattened fowl became more generally known the demand would exceed the supply.

It is difficult to give any particular reason why this profitable branch of poultry keeping has hitherto been neglected, but I should be inclined to attribute it to the following causes: (1) that few residents in this Colony have the necessary knowledge; (2) that the work, though profitable if well managed, cannot be called a clean occupation; (3) that work of this description demands constant attention and cannot safely be deputed to others; (4) climate, and the difficulty of obtaining certain foodstuffs.

Much depends upon the class of birds that are obtainable, but there is no doubt that any fowl will be considerably improved from an edible point of view by being properly fattened. In certain parts of England a large trade has been built up in this business, notably in Surrey, Sussex and Kent. There the demand has created the supply, and farmers and cottagers lay themselves out to breed suitable table poultry which they sell to the fattener; but the demand has increased so much during recent years that it has been necessary for the fatteners to purchase large numbers of fowls from Ireland in order to maintain their output. It is a noticeable fact that nearly all the best table fowls are crossbreds, the best being first crosses, *i.e.*, a cross from two pure breeds; this is probably due to the fact that a first cross matures more rapidly than a pure bred bird, and quick growth is most essential in this branch of poultry breeding.

To obtain the best prices in London it is essential that the table poultry shall have white skins and legs, for they are invariably of finer quality for table purposes than the yellow-skinned varieties. Unfortunately the Dorking, which is one of the best table birds that we have, does not do well in this climate, but the Favorelle, which is made by crossing the Brahma, Dorking and Houdan, appears to be suited to the climate and is an excellent table fowl and a good

layer. The following crosses can be strongly recommended for table purposes :—

Indian Game x Favorelle.	Houdan x Buff Orpington.
Indian Game x Buff Orpington.	Houdan x Plymouth Rock.
Indian Game x Houdan.	Houdan x Black Orpington.
Indian Game x Black Orpington.	Houdan x Wyandotte.

Note.—The cock is mentioned first in each case.

It will be noticed that some yellow-skinned birds are mentioned in the above list, but, in such cases, the other sex is in every instance a white-skinned bird, and experience has shewn that such crosses produce about 90 per cent. white-skinned chickens. The Old English Game is, perhaps, one of the finest flavoured table birds that we have, but it is rather small for marketing purposes and, though it may be used for crossing with other breeds, the progeny does not attain the same weight as is the case if the Indian Game is used.

A great improvement in table poultry can be made by caponising, and though this is a delicate operation when performed by a novice, yet, after practising on dead birds for the first few times, the operator quickly learns his business, and the losses will be very small.

To properly fatten a fowl, artificial means must be adopted and the bird must be crammed in order to obtain the softness and delicacy of flesh. Classes are provided for table poultry at nearly every show held in the Colony, but it is unfortunately only too true that these classes are usually the weakest on the show ; whereas in England the reverse is frequently the case. There are several methods of fattening, but that of cramming is the most general, probably owing to the speed with which this system enables a skilled operator to handle the birds.

The fowls are placed in specially constructed cages, the top, front and bottom being made of wooden bars fixed about 2 inches apart, the back being boarded. The length of the coops varies, but usually they are about 6 feet long by 18 inches high and are divided into three compartments, bars also being used for the divisions ; each compartment accommodates from 3 to 6 birds. The coops are placed on trestles raised about 3 feet from the ground ; thus the droppings fall through the bars at the bottom and are easily cleaned up and stored away for manure. It is usual to have the coops ranged round the sides of an enclosed yard the sides of which must be high enough to protect the birds from wind, and unless some other shelter is provided a small slanting roof about 3 feet wide should be erected over the cages, allowing about 1 foot to 18 inches air space above the cages for ventilation, while at the same time protecting the birds from the sun and rain.

In front is placed a long V-shaped trough usually made of wood about 3 inches in depth and running the whole length of the cage ; this is allowed to hang from the top of the cage by wire loops in such a position as to allow the birds to feed from it comfortably.

The fowls are placed in these outside cages for the first week or ten days and are allowed to feed themselves, the food being placed in the trough. They are fed twice daily, but, should any food not be consumed readily, the remains must be taken away and the troughs placed on the tops of the coops. If this is not done the fowls will frequently peck at the wood and eat splinters which frequently cause death. The food supplied during this stage usually consists of finely ground oats and sour skimmed milk. Frequently a fattener will give fresh arrivals a feed of bran and water with a little sour milk added, the idea being to cleanse the bird's system. The food is mixed into a sloppy consistency, this being necessary, as, during the process of fattening, no drinking water is given to the birds. It is perhaps necessary to point out that when using the term ground oats we do not refer to oatmeal; good ground oats rather resemble wheat flour in fineness of quality and contain the whole oat including the husk, which is very finely ground. Occasionally other meals are substituted, such as sifted barley meal, pollard, buckwheat meal, etc., but barley meal is rather too heating and does not produce the same quality of flesh as ground oats.

After the birds have been in the cages for about a week or ten days it will be noticed that some of them will peck at the food for a few minutes and then turn their backs on it. If their crops are practically empty when they do this it is time for them to be removed into the cramming shed. This shed, in some respects, is similar to the yard mentioned above, being fitted with cages in much the same manner, the main point of difference being that it is entirely covered in and is constructed so that it can be darkened. This is usually done by fitting dark-coloured blinds to all of the windows. The shed must be well ventilated, but, at the same time, it must be warm. It is when the birds are placed in this shed that the actual process of cramming commences. They do not have the opportunity of feeding themselves, but the food is forced into their crops by means of a cramming machine; all that the bird has to do is to digest it.

It has been said that this method of cramming is cruel, but those who have made such statements have evidently never had much experience of the work, for when once the birds have become used to the machine it is amusing to watch their eagerness to get the first turn. A short description of a cramming machine may be of interest. It consists of a small reservoir capable of holding about a bucketful of food, set on three legs, one leg being fitted with a wheel at the base, the other two each having a handle so that the machine may be wheeled along like a wheelbarrow. Underneath the reservoir is a small force pump fitted with a leather or rubber nozzle, the pump being worked by a treadle which the operator works with his foot.

In operating, the bird is gripped against the body by the left elbow, the left hand holding the head in such a position that the bird's neck is fully extended; with the right hand the beak is opened and the tube—which must first be moistened with a little milk or soft

food from the reservoir—is inserted into the mouth and passes easily down the gullet into the crop. The right hand is then placed on the crop of the bird and the treadle pressed with the foot which forces the food directly into the bird's crop, the operator being able to judge when sufficient food has been injected. Though taking some time to describe, the operation is very rapid and only occupies a few seconds. A skilled operator will hadle 250 birds in an hour, but care must be taken not to bruise either the gullet or the crop, or the bird will have to be killed.

The food in use when cramming is similar to that in use during the earlier stages, except that a little fat is added in the form of either tallow or mutton fat which must be boiled down before being added to the food.

Before the birds are put into the cages it is wise to give them a good dusting with insect powder in order to get rid of any lice. If this is not done, they are never at rest and do not fatten well.

Grit should be placed in the troughs twice a week; this is necessary, for there is always a certain amount of husk in the soft food which requires grinding.

It is impossible to fix any exact time for the birds to remain in the cages, but the average period is about three weeks; frequently a pullet will make up in 10 or 14 days, whereas a large-framed cockerel often takes four weeks. Should the birds refuse to eat when first placed in the cages it is well to starve them for 24 hours, after which they will have got used to their surroundings and will eat readily.

Before killing, it is absolutely necessary to starve the birds for at least 24 hours, especially when they have to travel by rail after having been killed; this clears the stomach of all food and they will keep better. Under no circumstances should crammed poultry be allowed to travel alive to market for they will lose as much weight in 18 hours' travelling as they will put on in a week.

The birds should be fed as regularly as possible, twice daily, but it does not matter if the cramming is done by lamp light provided the regular hours are observed. Should any food remain in the crop from a previous meal, the bird must not be crammed, but must be returned to its coop and not fed again till it has digested its food. Cleanliness is most important; the droppings should be cleaned up every day and stored in an old shed and turned over occasionally; when dry, they are readily disposed of to market gardeners and others.

* * * *

NOTES ON SHOWS.

Rand Poultry Club.

The Annual Show of the Rand Poultry Club was held on the 22nd and 23rd of June, and it would be a difficult task to criticise the management or arrangements in any way, for, taking the show throughout, it is by far the best that we have seen in South Africa. The greatest credit is due to the Secretary, Mr. H. Hjort, and his Committee for the excellent manner in which every detail had been thought out and provided for. If we may be allowed to offer one suggestion, it would be that, in future, school children should not be allowed to visit the show unless under the supervision of their parents or teachers. We do not in the least wish to discourage such a good object as the Committee evidently had in view, namely, the wish to encourage interest of children in pet stock, for we heartily agree that this is most desirable; but exhibitors must be protected, and children are apt to be thoughtless and frighten the birds unless a certain amount of control is exercised.

The entries were very strong and the quality throughout was, we consider, better than has been seen on the Rand on any previous occasion. The attendance must have been gratifying, for, at times, it was hard to get along the gangways in spite of the fact that plenty of space had been provided in this direction.

We were very pleased to see such a strong entry in the Turkey classes, which were a great improvement on previous years.

In table poultry there were very few entries, and had it not been for an exhibit staged by the Government Farm at Potchefstroom, there would have been practically no table poultry on the show. We should like to see more interest and competition in this direction, for there should be a good business capable of big developments to be built up in and around Johannesburg.

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Zoutpansberg Poultry Club.

The first annual open poultry show of the Zoutpansberg Poultry Club was held on the 18th and 19th of July, having been postponed for a week in order that His Excellency the High Commissioner might perform the opening ceremony.

Taking into consideration that this is the first open show held by this enterprising and go-ahead Club, and that Pietersburg is situated at the rail head and is practically 12 hours' journey from the nearest town of any size, the total of nearly 500 entries must have been highly gratifying to the promoters, and had it not been for the fact that it was rather late in the season and many exhibitors had mated up their breeding pens, the entries would, undoubtedly, have been larger.

Mr. Moore and his Committee had everything in good order, the pens being well arranged and plenty of room being provided for visitors. The quality of the exhibits was decidedly good on the whole, the competition in White Leghorns and Minorcas being especially strong.

We are glad to note that this Club is devoting a great deal of attention to the utility side of the subject, and, being situated as it is in a purely agricultural district, it has every chance of reaching the farmer; and that its influence is being felt in the district is evident from the number of farmers who are taking up this industry seriously and with a view to profit. We look forward with confidence to Pietersburg being one of the first districts in the Transvaal to gain a good name for the excellence and quality of its poultry produce.

EXTRACTS FROM EXCHANGES.

DRY-FARMING.

The United States Department of Agriculture, the Governments of the various States in which vacant public lands are located, and the great transcontinental railroads owning land grants have awakened, writes John L. Cowan in the course of an interesting article in the July number of the "Century," to a realisation of the importance of "dry-farming," or scientific soil culture, which means more to the people of the United States than do all of the costly irrigation projects now under way or projected for the future. Estimates of the amount of land that can be reclaimed by irrigation vary all the way from 50,000,000 acres up to 125,000,000 acres, with the weight of authoritative opinion decidedly favouring the lower figure. Yet if 1 per cent. of the money now being expended for irrigation works were made available for the education of the people who ought to be interested in dry-farming, it is probable that 500,000,000 acres of land—perhaps more than that—could be reclaimed from its present unproductive and comparatively worthless state just as rapidly as settlers, whether native-born or immigrants from foreign countries, could be taken to it.

It has been demonstrated on half a score of experiment stations, on as many more model farms maintained by Western railroads, and on hundreds of private farms, that all that is necessary on the plains and in the inter-mountain parks and valleys is intelligently to make the most of the rains and snows that fall in order to grow as good crops as can be raised anywhere. In other words, farming methods must be adapted to natural conditions. This seems so simple and self-evident that the only wonder is that men have been so very slow in finding it out. It ought not to be hard to believe that lands that produce the rich buffalo and grama grasses of the plains without cultivation can be made to produce crops still more valuable with cultivation adapted to the soil and climate. Carrying the same argument a little further, there are many who believe that wherever sage-brush, cactus-plants, yucca, Spanish bayonet and greasewood will grow, plants of economic value may be made to grow also.

However, what the National Department of Agriculture, the various State Governments and the great railroad corporations have at last been made to see has been demonstrated every season for twenty consecutive years by Mr. H. W. Campbell of Lincoln, Nebraska, the pioneer "dry farmer" of Arid America. In scores of places from the James River to the Arkansas he has been uniformly successful in producing, without irrigation, the same results that are expected with irrigation, with comparatively little additional expense, but not without a great deal more watchfulness and labour. What

Western people have become accustomed to calling the "Campbell system of dry-farming" consists simply in the exercise of intelligence, care, patience and tireless industry. It differs in details from the "good-farming" methods practised and taught at the various agricultural experiment stations; but the underlying principles are the same.

These principles are two in number. First, to keep the surface of the land under cultivation loose and finely pulverized. This forms a soil mulch that permits the rains and melting snows to percolate readily through to the compacted soil beneath, and that, at the same time, prevents the moisture stored in the ground from being brought to the surface by capillary attraction to be absorbed by the hot, dry air. The second is to keep the sub-soil finely pulverized and firmly compacted, increasing its water-holding capacity and its capillary attraction and placing it in the best possible physical condition for the germination of seed and the development of plant roots. The "dry-farmer" thus stores water not in dams and artificial reservoirs, but right where it can be reached by the roots of growing crops.

Through these principles, a rainfall of twelve inches can be conserved so effectively that it will produce better results than are usually expected of an annual precipitation of twenty-four inches in humid America. The discoverer and demonstrator of these principles deserves to rank among the greatest of national benefactors. He has not merely made two blades of grass grow where only one grew before, but he has made it possible to cover with wheat and corn, alfalfa and other useful crops, tens of thousands of square miles of fertile land on which nothing but sage-brush, cacti, Kansas sunflowers and bunch-grass are now found.

Water moves in the soil by capillary attraction—up as readily as down. To prevent it from rising to the surface after it has been stored beneath is the primary object of the loose soil mulch composing the two top inches of soil. This answers the purpose of a lid on the natural reservoir, preventing the moisture from rising to the surface and thus evaporating in the hot, dry atmosphere. At the same time, this soil mulch forms an open, porous bed upon which the rains and snows fall, permitting the moisture to percolate readily through into the compacted ground beneath. Special agricultural implements have been designed and brought into use for packing the sub-soil and for stirring and pulverising the surface, but a detailed description of these would be aside from the purposes of this article.

Dry-farming is essentially scientific farming, and for that reason the term used by Mr. Campbell, "scientific soil culture," is, perhaps, more truly descriptive than the popular term. Nevertheless, its principles can be, and are, applied just as successfully by men who have little of the education of the schools as they are by college graduates. However, no farmer in the arid belt need hope for even moderate success without unceasing and tireless diligence. The remark once made of the lands of the Dakotas, "tickle them with a hoe and

they will laugh with a harvest," is very misleading. It is true that in the Dakotas and elsewhere as well, great bonanza wheat-farms are operated at a profit with no other cultivation than the preliminary preparation of the soil, consisting of shallow plowing and harrowing. Sometimes even the harrowing is dispensed with. These huge wheat-farms rarely yield a crop of more than from ten to fourteen bushels to the acre, and operations, to be profitable, must be conducted on an enormous scale. If, instead of merely "tickling" the lands, the owners of the bonanza farms were to cultivate them thoroughly, they would be rewarded with a harvest fourfold as great.

After the land has been deeply ploughed, the under-soil packed by the sub-soil packer, and the surface harrowed and pulverized, a full year should elapse before the first crop is planted in order to obtain the best results. This season is needed for the collecting and storing of water. In the winter and early spring heavy snows cover the ground. When these melt in the spring, instead of draining off the surface or evaporating, as they have done for ages, they sink into the reservoir prepared for their reception. As soon as the surface is dry enough, the gound is harrowed over and over again to place the soil mulch in proper condition. This is repeated after each rain until seeding time arrives. The seed is then drilled in just deep enough to place it below the soil mulch in the moist compacted soil beneath, causing germination in the quickest possible time.

After planting, the dry farmer does not trust to luck and Providence to do the rest, and blame it all on the weather if the final result is failure ; but he continues to harrow over the ground after each rainfall until the growing crop is too far advanced to permit of this without causing its destruction. By that time it covers the ground fairly well, protecting it to some extent from the sun and hot winds, and making the constant loosening of the soil mulch less imperative.

No sooner is the crop harvested than preparation begins for the next seeding. The plough follows close behind the harvester, cutting a furrow seven inches deep. Behind the plough follows the sub-soil packer, similar in shape to a disc-harrow, but having ten sharp wheels that cut deeply into the ploughed ground and press the soil firmly together. The packer is drawn very slowly, but all ground ploughed is packed and harrowed before work is stopped for dinner or for the night's rest. No matter how long a time must elapse before the planting of the next crop, the ground is harrowed over after every rain, but never when it is dry. Through winter and summer this persistent and untiring stirring of the soil mulch is continued, whether anything be planted or not. The dry farmer, therefore, knows no season of rest or idleness. He knows that eternal diligence is the price he must pay for good crops. He not only believes, but practises, "the gospel of work," and richly deserves the ample rewards that are surely his.

It has been thoroughly demonstrated that rational dry-farming methods, as above outlined, will produce from three to five times the

results of ordinary farming methods on the same lands. In the sub-humid belt between the ninety-seventh and the one-hundredth meridians, the additional labour and expense amount to about 25 per cent. West of the one-hundredth meridian, twice the usual amount of labour is necessary. This is partly off-set by a saving of more than two-thirds of the seed, and is richly compensated for by an increase in the harvest amounting to from 200 to 400 per cent. The ordinary farmer on the plains sows forty quarts of wheat to the acre, and threshes anywhere from nothing at all up to twenty bushels. The average crop grown in Kansas for the last fourteen years has been thirteen bushels to the acre, and fifteen bushels to the acre was the highest average for the State in any year in that time. The farmers who follow the Campbell system sow only twelve quarts to the acre, and never fail to harvest from thirty-five to fifty-six bushels. Last year the third largest crop ever produced in Kansas was cut. It averaged twelve and three-quarters bushels, aggregating 75,576,867 bushels, grown on 5,854,047 acres of land. The average crop grown in the State by users of dry-farming methods was thirty-seven bushels to the acre. If this average had been maintained throughout the State the Kansas crop for 1905 would have amounted to 216,599,739 bushels.

The average annual precipitation between the foot-hills of the Rocky Mountains and the Kansas-Nebraska line is 14.93 inches. In this arid region, in which long experience has proved ordinary agricultural methods to be unprofitable, there is a margin of almost three inches over the requirements for the successful following of dry-farming methods ; and Julesberg, Limon, and many other flourishing agricultural communities are living witnesses of the efficacy of the Campbell system. While an annual rainfall of twelve inches is sufficient to bring to maturity any ordinary farm crop, there are many special crops that can be grown with a good margin of profit with an average annual rainfall of less than ten inches. Experiments are now in progress for the development of varieties of wheat, alfalfa, and corn possessing greater drought-resistent qualities than any now known.

Hundreds of striking instances of successful farming by the methods of the Campbell system of soil culture might be cited ; but a very few examples showing the growth of the idea will suffice.

Twenty years ago, Mr. J. P. Pomeroy, now of Colorado Springs, acquired 30,000 acres of land in Graham County, Western Kansas, and founded Hill City almost in the centre of the tract. For fourteen years portions of this land were cultivated by old-fashioned methods. In all that time only one good crop was harvested, that being in a season when the rainfall was abnormally large. He had heard of Mr. Campbell and his system of dry-farming, and sent for him, telling him to go ahead and show just what he could do on land on which profitable farming by ordinary methods had been proved to be impossible. Mr. Campbell laid out a model farm on the very land that had been tried often with discouraging results. Last season the sixth successive crop was harvested. In the fourteen years in which

old-fashioned methods were followed, thirteen failures were scored. In the six years in which the Campbell system has been on trial on the same lands, a crop failure has been unknown. The smallest yield of wheat per acre in that time has been thirty-five bushels, while farmers close by have never obtained more than thirteen bushels per acre and very rarely even that. The yield of corn, oats, potatoes, alfalfa, berries, small fruits, and vegetables is equal to that obtained from the best of the irrigated farms around Greeley, Fort Collins, Grand Junction, and other parts of Colorado, "under the ditch." A six-year-old orchard is in prime condition, the trees being as large as eight-year-old trees in the famous fruit-growing district of Palisades. A more complete vindication of all the claims made by advocates of the practicability of farming on the plains without irrigation could not well be imagined.

Near Julesberg, Sedgwick County, in north-eastern Colorado, dry-farming is practised more generally than in any other portion of the west, with highly gratifying results. The average crops reported last year by the farmers of that region without irrigation were: wheat, 35 bushels to the acre; corn, 50 bushels; potatoes, 200 bushels; rye, 30 bushels; oats, 65 bushels; millet, 2 tons; and cane for forage, 5 tons. As a result of this showing, many of the farmers of the neighbourhood who have been irrigating their lands have sold or given up their water-rights and abandoned the use of the ditch entirely. A similar movement has been begun at Fort Collins, some of the farmers who tried both methods last season finding that dry farming yielded larger returns than they were able to obtain in adjoining fields by the use of irrigation. However, action of this kind is at present ill-judged and premature, and is discouraged rather than countenanced by the true friends of dry-farming. No doubt irrigation is the best, safest, and most economical treatment for lands on which irrigation is practicable. It is to the millions of acres of arid land that can never be irrigated because there is not water enough that dry-farming comes as a messenger of hope.

There is nothing inimical to irrigation in the dry-farming movement. Each has a wide field before it. In many regions it is probable that a combination of irrigation and dry-farming methods will be found desirable. By an economical use of the water stored in reservoirs, in accordance with dry-farming principles, and by conserving the rains and snows that fall in the soil as taught by the advocates of dry-farming, and drawing upon the irrigating ditches only to supply the deficiency, it is possible that irrigation reservoirs may be able to supply double or treble the acreage they can serve by the present wasteful methods, and that great stretches of territory in which the rainfall is too small to allow the successful application of dry-farming methods alone may be covered with waving grain fields.

Last autumn the little settlement of Limon, situated on the dry plains of Lincoln County, Colorado, leaped into wide-spread prominence on account of the surprising exhibit of agricultural products made at the second annual harvest festival of the Eastern Colorado

Fair Association. The surrounding country is far from the possibility of irrigation, and its agricultural future depends absolutely upon the success of dry-farming methods. The exhibits of garden vegetables, cereals, and forage crops were equal to any made at any county fair in the country, and were amply sufficient to silence the critics who have long claimed that eastern Colorado never can become a prosperous farming country. A twenty-pound squash, a thirty-five-pound head of cabbage, and an eight-pound sugar beet were among the prize-winners; as also were specimens of potatoes that yielded 200 bushels to the acre, of winter wheat that yielded 35 bushels to the acre, of corn that yielded 40 bushels to the acre, of rye that yielded 25 bushels to the acre, and of Milo maize that yielded 10 tons to the acre. That diversified farming is possible without irrigation in this district was well proved by exhibits, in addition to the above, of water melons, tomatoes, apples, turnips, carrots, red beets, radishes, pumpkins, squash, onions, Kafir corn, sorghum, brome-grass, timothy, and many other productions of the field, garden and orchard.

The cynical have often remarked that the price at which land could be bought on the plains was gauged by the ability of the owner to pay taxes. Many thousands of acres have changed hands at one dollar, or even less, per acre, because the owners thought it better to take a little than to lose all. Less than two years ago many sales were reported as low as $3 and $3.50 an acre. Last year, prices ranged from $5 an acre to $7.50, and even up to $10 and $12; and the President of the Colorado State Commercial Association is on record with the prediction that in a short time no land in eastern Colorado within a reasonable distance of railroad transportation can be bought for less than $25 an acre. This revolution in land values is due mainly to the activity of men who have been watching the results of experiments in dry-farming. Some have bought for speculation, some for cattle and sheep ranches, but more than all for active farming. One company has bought 300,000 acres of arid land in the Panhandle of Texas, and 80,000 acres more in eastern Colorado, to be subdivided into small farms and sold to those willing to cultivate by the Campbell system.

* * * *

THE PREPARATION OF WOOL FOR MARKET.*

Briefly put, every colonial station of even average dimensions places at the head of the clip a competent classer, whose business it is to see that every fleece is properly classed as to quality, then skirted

* We extract a few practical points for sheepbreeders contained in an address by Mr. S. B. Hollings on this subject which was delivered at the Seventh International Conference of Sheepbreeders held at the Guildhall, Derby, on June 26th last, under the auspices of the National Sheepbreeders' Association. The address was listened to by an audience which included representatives from almost every sheep-breeding country in the world, and, after a keen discussion, a vote of thanks to Mr. S. B. Hollings for his valuable paper was carried unanimously. [ACT. ED., *T.A.J.*]

and locked before being put into the bale to be packed for market. Every shorn fleece is handled with intelligence, careful attention being paid to those points which a grower knows will tell in his favour when the wool is offered for sale. A good attempt is usually made to keep all the qualities separate, "mixed" parcels only being taken by those who like to buy such a clip of wool at more or less a speculative price. *Uniformity of quality* is a very valuable feature in any parcel of wool, and buyers know how to appreciate this when they see a clip straight and uniform in regard to quality and breed of wool. It is a great mistake to bale together fine and coarse fleeces, and even when handling fleeces of the mutton breed it pays to bale separately the fine, medium, and coarse fleeces.

It must be remembered that before these leave the sorting table, every fleece, without exception, is taken and skirted—that is, the heavy bellies and britch are removed, the remaining fleece then being taken and rolled up separately. I have not time here to go into every detail of the operation, everyone present knowing exactly how the work is done. The great thing to remember is that seldom anything of an objectionable nature is rolled into the fleece, the bellies, stained pieces or britch, and the locks being baled separately, and then each lot being sold on its merits. By this method of marketing wool, buyers approach with confidence Colonial clips, men being satisfied that the middle of the bale will be as free of foreign matter as are the fleeces on the outside edge. A vast improvement has of late years been noted in connection with the wools from the River Plate, though even here there is hardly that uniformity in classing and preparation for market which one observes, say, in New Zealand fleeces of a corresponding quality. I now leave out Australian wools, because the great bulk is merino; English, New Zealand and River Plate wools all coming under the category of crossbreds. During the past ten years—thanks to the introduction of the best English blood, and the adoption more or less of Colonial methods—River Plate wools have vastly improved, both in quality, character and general get up. Still, there is room for improvement, and particularly the system of selling all the qualities together, which so frequently is the case. When fine and coarse qualities of crossbreds are sold together, the buyer, as a rule, tries to secure the parcel at the value of the coarser quality, consequently the grower makes a sacrifice which he need not do if he will, before baling, separate the fleeces into their respective qualities, say, fine, medium and coarse. A New Zealand clip, as a rule, is done in this fashion, hence we see the big prices being paid to-day for New Zealand grown wools. It does, indeed, show to what perfection crossbred wools are being grown in New Zealand, when greasy half-bred is selling from 15d. to 17d. per lb., this being the reward for general excellence on the lines I have just named. It is hardly to be expected that English sheep farmers will go to the trouble of classing like we see in New Zealand, but as regards keeping out extraneous matter, it must be done, otherwise that clip will inevitably suffer in regard to price per lb. No buyer to-day wants "muck," or

dirt at the price of wool, hence the question of false packing must be considered.

Evils of False Packing.

The evils of false packing cannot be over-estimated, and where-ever practised it is bound to reflect discredit on the woolgrower who does it. All honour to Australasian pastoralists for setting their minds against such a system, and it would be a good thing if the same could be said for British and South African sheep farmers. I venture to say that the worst element in connection with our home-grown fleeces is the bad way they are prepared for market, while Cape wools are notorious for the excessive wastiness and falseness in which they are sent to market. The system of selling wool in Cape Colony can be vastly improved where the up-country storekeeper pays the same price for the badly got up wool as he does for the clip that has been well locked and skirted, but here in England there cannot be any possible excuse for any sheep farmer to roll into his fleeces heavy bellies and britch without the daggings or "muck lumps" being removed. I am certain that the farmer who will persist in adopting this evil practice is doing so to his own financial injury, it being a mistaken policy for any man to think he is gaining anything by doing it. Some will even put into the middle of a fleece washed locks, and then see that such fleeces are put into the middle of a bale. Others never think of removing the heavy lumps of dirt that are adhering to the bellies and the britch, rolling in the entire lot. This will never make up into cloth, but will have to be clipped off; while even if the wool comes to be scoured, all this extraneous matter will go down the drain. It must ever be borne in mind that every wool buyer acts upon the adage "once bitten, twice shy." If a buyer purchases a clip of wool and the same turns out to have been badly handled, that farmer's next clip will be ear-marked, and that buyer will make a serious attempt to get back out of the farmer the loss he encountered the year previous. Nothing shakes a buyer's confidence so much in any clip as to be deceived in the "clean yield" which he estimates the wool will give, and "lost confidence" is a serious matter for any clip of wool no matter where grown. Let the shearing be done on a clean swept floor, and by no means let the operation be conducted on a bed of straw. The floor swept clean will prevent vegetable matter from becoming entangled with the wool, and see that everything is clean and the whole fleece carefully gathered up before the shearer commences to shear the next sheep. False packing cannot be justified at all, but is decidedly injurious to the sheep farmer who practises the habit. Remember here that honesty is the best policy.

Benefits of a Good Name for a Clip.

No better asset can a wool grower have for his clip than a good name, and this can, perhaps best be appreciated by Colonial squatters. Wool buyers in this country know that certain clips have won for

themselves a name which is synonomous with integrity and honesty, and when offered in London or Australian markets they command the unreserved attention of every member of the trade. This is due entirely to the wool possessing excellent manufacturing characteristics, and also to the upright and straightforward way in which the clip is prepared for market. "Faking" is an unknown quantity, and in this respect our home wool growers can with advantage copy the example. A good name for a clip of wool benefits the owner just the same way as a bad name injures the producer, and when a clip becomes known to yield well, and there has been no attempt at faking, that clip always receives the full advantage of competition, and the best price possible that is ruling. South African wools have lost prestige on the markets of Europe because they have done so badly for buyers, the preparation for market being so badly performed. When growers will persist in rolling into their fleeces everything that has been picked up while the wool was growing, no surprise need be felt at the "gingerly" way in which such wools sell. In a quiet time, and when prices are low, a buyer favours the most that man's wool which he knows in the past has been properly skirted and locked, while if he handles a doubtful clip, he allows sufficient margin to compensate him for any unexpected eventualities. The reason why all objectionable matter should be removed is because, first, it is a dishonest practice to bale it with a straight, full grown fleece ; second, because it encourages suspicion ; and thirdly, because vegetable matter is not wool.

VEGETABLE MATTER.

Vegetable matter in wool has this last eighteen months occupied a very prominent position in the wool world, due to a large extent to its being on the increase. Growers really cannot fully estimate how injurious this is, manufacturers alone being able to estimate the importance of keeping fleeces free from everything vegetable in character. Put it down as a well-defined principle that more vegetable matter there is in shorn fleeces, and the more will buyers fight shy of it in the future, besides paying less for it. Wool containing loose hemp, string, straw, short fluffy bits from the inside of tares, means much extra cost in manipulation, while, owing to vegetable matter not taking the dye like wool, has been the direct cause of serious loss arising through spoiled pieces. There are several forms of vegetable matter which wool growers need to watch with the strictest vigilance. While the fleece is growing, there is the vegetable matter which is picked up. In colonial fleeces this is represented by burrs, seeds, and shivs, while in English wools the worst feature to contend with is straw. After washing, sheep should never be turned into straw before shearing, while even in the turnip field straw should not be spread unless the land is very heavy and wet. Then there is vegetable matter getting into the fleece while shearing is being conducted, and this should be avoided by the shearing floor being kept entirely free from all extraneous matter. Of course, this can be picked out at

the sorting table, but it means increased cost, and this the sheep farmer has to pay by receiving less for his clip. Then there is the worst feature of all, namely, the tying up of fleeces with loose, fluffy, jute twine. This practice has nearly disappeared, and the sooner it is a relic of the past the better. It is mostly practised in the South of England, and principally in the counties of Somerset and Devon. Wool fleeces do not need tying with band at all, and the few stations in Victoria, Australia, where it is still done, need not continue the practice. Then there is the evil arising from using poor tares. When this is done, the loose, fluffy bits from the inside rub off on to the wool, and no amount of sorting will rid these from the wool. When hemp or jute fibre gets into the wool and passes through the scouring machine, it gets so broken up that it is lost sight of. These fibres adhere most tenaciously to the wool fibre through all the processes of manufacture, and when the pieces come to be dyed they refuse to take the colour like wool ; consequently they come up in the finished article in a very objectionable way, the pieces being specky, which, in dark, solid shades like blacks and browns completely spoils the piece. Before wool is placed into any tares, they should be turned inside out and well shaken, taking care to conduct this operation away from the shorn fleeces. This is a most important matter, and deserves serious attention at the hands of both home, colonial, South African, and River Plate sheepmen. Paper-lined tares have been suggested as a possible remedy, and no doubt a good deal can be said in their favour. A good quality tare should be used, this greatly minimising the evil.

RURAL REPORTS.

BETHAL.

June.—The weather has been very dry with frosts at night. The mealie crop has now been harvested and farmers are busy shelling, but the crop is poor. Vegetables are scarce. The yield of crops and current prices are as follows :—Mealies, from 2 to 3 bags per acre ; forage, 20 to 25 cwts. per acre ; and potatoes about 20 bags ; mealies, 9s. per 200 lbs. ; forage, 6s. per cwt. ; potatoes, 15s. per bag. Stock are in good condition. The veld is very dry and water is scarce. Native labour is scarce—wages, from £1 to £2 per month.

July.—No rain has fallen during the month. There is no ploughing being done owing to the dryness of the season and the hardness of the ground. Harvesting is now finished with the exception of a few potatoes. There are no vegetables. The following are some current prices of crops :—Mealies, from 10s. to 10s. 6d. per sack ; oat hay, from 4s. 6d. to 6s. per 100 bundles ; manna, from 9s. to 10s. per 100 bundles. Live stock are in fair condition. The veld is getting very bare and water is scarce. Native labour supply is fair—rate of pay, 30s. to £2 per month.

August.—The weather continues dry and windy, with frost early in the month ; milder towards the end of the month. Ploughing is not yet in progress owing to the ground being too hard. The current prices are :—Mealies, 12s. per 200 lbs. ; potatoes, £1 5s. ; forage, 5s. per 100 lbs. Stock are in fair condition. The majority of stock are at present in the low veld. The veld is dry and withered. Water is getting scarce. Native labour is fair—£2 per month.

BOKSBURG.

July.—The weather has been clear and bright. Cold winds and heavy frost on 12th, 13th and 14th. Some ploughing is taking place for spring crops. The mealie and Kafir corn harvest is now completed. Vegetables are fairly plentiful. Green barley, forage and mealies are fairly plentiful. Poultry is rather scarce, good fowls realising up to 3s. a piece ; turkeys, 10s. to 12s. 6d. ; and mealies, 13s. a bag. Generally speaking not much work is at present being done in the way of agriculture. Gardens and orchards are being cleared and got ready. Fruit trees are being pruned and prepared in anticipation of an early spring. A good rain is urgently required, as both the gardens and veld are suffering from the drought. Stock are now beginning to show signs of falling off on account of the cold winds. The water supply is very scarce and many dams are empty. The rate of pay for native labour is £3 per month and food.

August.—The weather has been windy, cold and bright ; cloudy in parts towards end of the month ; frosty weather at the beginning

of month. Ploughing is taking place in expectation of early rains, but mostly in low-lying ground. Fruit trees are coming on well and good crops are anticipated, provided there are no late frosts. The following are some current prices of crops :—Mealies, 12s. per bag ; green barley, 22s. 6d. ; forage, 14s. to 16s ; Boer meal, 28s. 6d. to 30s. ; manna, 14s. to 17s. per 100 bundles. Fruit is very scarce and dear. Live stock are keeping in poor condition. The veld is very dry and rain badly needed. Native labour is fairly plentiful but unsatisfactory.

Carolina.

August.—No rain has been reported during the month ; there have been occasional mists during the nights. Agricultural operations have not yet been resumed on dry lands ; wheat and forage crops under irrigation look well, but the amount of ground under water is not very great. Live stock are in poor condition where the farmer has neglected to lay in winter provender. The low veld farms have provided no winter feed this year owing to the very dry summer and entire absence of late or early rains, and sheep farmers have lost heavily, lambs being either born dead, or dying through weakness, and, in some cases, the farmer has been compelled to kill the lambs to save his ewes.

A few progressive farmers who, in the summer, have mown and stacked sweet grass are in a better position ; in every case they express their attention of making more hay next year.

Farmers appear to have no difficulty in getting native squatters ; contractors on the new railway construction are, however, unable to get sufficient boys, although they offer £3 a month. The asbestos mines, though able to get temporary labour for surface work at the above rate, have been obliged to import Xosa boys.

There was a shortage in all crops this year, and forage is now practically unobtainable. Mealies are not being offered in great quantities, and the price is 12s. a bag. Manna is obtainable at 20s. to 25s. per 100 bundles. A local firm are importing Australian compressed forage and find it in great demand.

Ermelo.

August.—The weather for the early part of the month was extremely cold, accompanied by cutting north-west winds. Later, it became much milder with occasional warm winds and some mists from Swaziland. No rainfall was recorded. Preparations were made for ploughing. Towards the latter end of the month all the peach trees were in bloom, and, if no frost occur, a fair crop of fruit may be expected. The price of mealies per bag averages about 11s. to 12s., and potatoes from 15s. to 20s. per bag. Stock of all kinds is fairly poor owing to the scarcity of pasturage due to long continued drought from the beginning of the year and early frosts. Water has become scarce in many parts of the district, and if no rain falls within the

near future, it is expected that there will be considerable loss amongst cattle and sheep. Labour generally has been very scarce, the rate on farms being from 8s. to 15s. per month, and in the towns £2 per month for natives. There is practically no white labour. Two applications have been received for the Government bore for irrigation purposes, and if the boring is attended with any degree of success many farmers intend to apply to have boring done on their farms.

Heidelberg.

July.—With the exception of a cold snap for two or three days the weather has been mild for July. Owing to the unprecedented scarcity of water there has been very little sowing during the month. Mealies and manna are the only crops obtainable now, for which 10s. 3d. a bag and 12s. a hundred bundles are obtained respectively. All live stock are, so far, in good condition. Unless we have early rains it is feared that there will be serious loss in stock. Many farmers have sent their flocks to other districts both for feeding and water. Native labour is scarce.

August.—No rain has fallen during the month. The weather has been mild. Practically no sowing has taken place owing to the scarcity of water. Some ploughing has been done in anticipation of early rains. Fruit trees show great promise, but the season is late. Large stock are in good condition and healthy. Sheep are in good condition, but, owing to the lack of rain, the young grass has not started and it is feared there will be a loss in lambs.

Klerksdorp.

June.—The weather has been cold and frosty. Rainfall, .04. No ploughing, sowing or planting has been done during this month. Small crops of green barley are coming in. The winter crops are coming on satisfactorily. Fruit and vegetables are scarce. The current prices are as follows :—Green barley, 10s. per 100 bundles ; butter, 1s. 6d. per lb. ; chaff, 6s. 6d. per bale ; eggs, 1s. 4d. per doz. ; forage, 25s. per 100 bundles ; mealies, 10s. per bag ; oranges, 6s. per 100 ; potatoes, 10s. to 17s. 6d. per bag ; tobacco, 4d. to 1s. per roll, 4d. to 6d. per lb. (cut) ; firewood, 25s. to 50s. per load.

Boring operations have been carried on at Oorbeitjesfontein and Hartebeestfontein with satisfactory results by means of a Government bore, and a private bore also gave satisfactory results at Hartebeestfontein and Geduld. In one instance, at Geduld, the water rose to within 10 inches of the surface in a hole about 90 feet deep. Live stock are falling off in condition. Water is scarce, and the prospects for winter keep are not good owing to ravages by locusts. Native labour is scarce.

July.—The weather has been cold, calm and frosty. Oats on irrigable land are being sown. Vegetables and fruit are scarce. The following are some current prices of crops :—Green barley, scarce, 12s. 6d. per 100 bundles ; cabbages, 9d. each ; cauliflowers, 1s. each ;

chaff, 8s. per bale ; forage, 25s. per 100 bundles ; mealies, 11s. per bag ; oranges, 6s. per 100 ; potatoes, 16s. per bag ; tobacco, 4d. to 1s. per roll, and 4d. to 6d. per lb. cut.

The Government bore continues to give satisfaction and is still operating at Hartebeestfontein. Several holes have been completed, each resulting in an ample supply of water at an average depth of about 120 feet. A diamond drill has also been provided by Government on the farm Otterfontein, but little or no work has been done yet. The condition of live stock is rather poor. The veld is bad. Some farmers have stacked a quantity of hay which is being found useful now. Native labour is scarce—wages normal.

LICHTENBURG.

June.—There has been no rain during the month. The atmosphere fell below the freezing point on 12 nights. Mealies and Kafir corn are still being reaped by farmers. Mealies are turning out a little better than anticipated. Kafir corn is not turning out so well. Winter crops in the town are looking well and there is an increase in the district this year. Vegetables are now very scarce. The current prices are as follows :—Mealies, 7s. 6d. to 9s. 6d. ; Kafir corn, 6s. to 11s. ; potatoes, 7s. 6d. to 18s. 6d ; wheat, 20s. to 25s ; oat hay, 8s. to 9s. 6d. per 100 lbs ; green barley, 3d. to 4d. per bundle.

All live stock are in good condition and the grazing continues to be good. The pans are, unfortunately, drying up very rapidly. Native labour is scarce as usual. Natives are now reaping the benefit of their crops. There is not much work being done on the farms just now, however, excepting in cases where they have been fortunate enough to have large quantities of crops to reap.

July.—Heavy frosts occurred during the month, the thermometer registering 17 degrees in one night, and 21, 24 and 25 for three successive nights. Farmers have now almost finished ploughing for winter crops. Those crops sown before have suffered by the heavy frosts of this month. The current market prices are as follows :—Mealies, 10s. to 11s. 6d. per bag ; Kafir corn, 10s. per bag ; potatoes, 18s. to 27s. 6d. per bag ; barley, 2½d. to 4d. per bundle. The veld is very dry and a good deal of grass is being burnt again. Stock are feeling the effects of a cold winter. Native labour is still scarce. Rates of pay, from 25s. to £2 10s. per month.

August.—Frost was registered on 11 nights in the first half of the month, the thermometer registering 22 degrees on three nights. Nothing to speak of is being done this month. The current market prices are :—Mealies, 10s. to 12s. per bag ; Kafir corn, 8s. to 11s. 6d. per bag ; green barley, 3d. to 4½d. per bundle ; potatoes, 21s. to 25s. per bag. Vegetables are very scarce and expensive. The veld is getting very dry and water scarce. Many of the dams have dried up and farmers are trekking with their stock. Labour is scarce.

Marico.

June.—No rain was registered at the local meteorological station. Mean maximum temperature, 68.8° F.; mean minimum, 33.2° F.; mean force of wind, 59.8 miles per day; mean relative humidity, 57%; mean sunshine, 97.93%. Crops are suffering slightly for want of rain. Fruit trees and vines are being pruned and sprayed. Our market is very meagrely supplied in vegetables, and prices, consequently, are very high. Quotations for produce are quite on a par with Johannesburg except oat hay, which is selling at from 35s. to 45s. per 100 bundles, averaging 4 lbs. each. Live stock is falling off owing to there being very little grass to feed on. Farmers have gone in very extensively for sheep farming of late and find it very remunerative. Water supply is getting very scarce. Native labour is scarce.

July.—Rainfall nil. Mean maximum temperature, 69.55° F.; mean minimum temperature, 29.67° F.; mean force of wind, 58.5 miles per day; mean relative humidity, 54.2%; mean sunshine, 96.9%. Mealies and oat hay have slightly risen in price and are being quoted at 14s. and 47s. 6d. respectively. Other cereals remain at last month's quotations. Boer meal is very scarce; large quantities have been imported from Port Elizabeth. Fire wood is very plentiful. Live stock are looking miserable owing to the wretched state of the veld. The water supply is getting less and less. Native labour is very scarce indeed.

Standerton.

June.—The weather has been fine and warm during the days, but cold at nights with sharp frosts, whilst the latter part of the month was windy. Most of the crops in the district have been harvested, and several farmers are breaking up land for the following season, repairing fences, building new kraals, and generally repairing farm implements. The crops have yielded a poor return owing to drought and bad season generally. Of fruit and vegetables there was practically no yield (potatoes excepted). All live stock are in good condition, considering the scarcity of water and the poor condition of the veld. The water supply on the farms is low, and it is feared that a number of farmers will have to migrate to the low veld for the remainder of the winter. Four hundred head of cattle were imported during the month from the Orange River Colony by dealers and sold at the port of entry under the supervision of the Stock Inspector. A good number of farmers attended the sale, and the majority of the stock were sold, realising fairly good prices. Regular sales are held on the Market Square every Saturday, and a moderate amount of stock is sold. The Platrand Farmers' Association intends holding a stock sale about the 25th of July, and a good number of entries of stock of all classes is expected. The labour supply is not considered good, as the natives demand £2 to £2 10s. and food, and have a preference for town work. The squatter system is greatly used in this district.

July.—The weather has been cold this month with frosts at night and strong winds during the day. New ground is being broken up on several farms. Most of the crops are harvested and farmers are now engaged in bagging. There are a number of baling machines in the district, and grass cutting and baling is carried on to a rather large extent. Farmers have commenced planting early potatoes in small quantities. Orchards have been attended to, pruning and transplanting are still being carried on, and this coming season promises to be a very good fruit season. The condition of live stock is fair, the veld being very dry, and the scarcity of water is beginning to be felt. Most of the farmers in the district have taken advantage of the steam mealie sheller which has been going from farm to farm. Labour supply remains unchanged.

August.—Very dry and high winds have been frequent. Latter part of month has been mild. A few farmers are ploughing and breaking up new lands, but the majority are waiting for rain. The condition of live stock is fair. The veld is very dry and water is becoming very scarce. There is no change in the labour supply.

Volksrust.

July.—The weather during the month has been very cold, and bitter south-easterly winds were general. Maximum temperature, 73.2, on the 30th, ; minimum temperature, 18.3, on the 28th. No rainfall. Very severe frosts on the 1st, 4th, 12th, 16th, 17th, 18th, 23rd, 24th, 28th and 29th. Building operations are at a standstill. Ploughing has not yet been started and very little work is being done on the farm. Crops this year are only fair. The following are present prices :—Mealies, 10s. 6d. to 12s. per sack ; potatoes, 15s. to 17s. 6d. per sack ; forage, from 6s. to 6s. 9d. per 100 lbs. Vegetables are scarce.

Things generally are in a very bad state, much worse than they have been during the last three years. Horses and cattle in the district are looking fairly well, but bad reports about the sheep are to hand from the winter veld. A great number of the farmers are bringing their flocks back home owing to the bad grazing. This is much earlier than usual. Water is scarce generally.

August.—The first five days of the month were very cold, but from that date until the end of the month the weather was considerably milder than in previous years. Maximum temperature, 77.3, on 25th ; minimum temperature, 16.8 on 3rd. Farming operations have not yet commenced. Burning of the veld in all directions has taken place in anticipation of an early rainfall. The prices of last season's crops are rising, especially potatoes : mealies, 10s. 6d. to 12s. 6d. per bag ; potatoes, 13s. to 16s. per bag ; and oat forage, 6s. 6d. per 100 lbs. In some instances the lambs have had to be destroyed at birth owing to ewes being so low in condition. Water is very scarce.

USEFUL FACTS AND FIGURES FOR FARMERS.

HOW DEVONSHIRE BUTTER IS MADE.

Visitors to London are often attracted by the notices which adorn the shops and salerooms of the great city, and country people naturally espy those signs or notices relating to the productions of the farm or dairy. A familiar legend—"Pure Devonshire Butter"—is often read with interest; but it does not always follow that all butter so placarded is the "real" thing, and came from the land of "junket" and "cream." There is a characteristic flavour about Devonshire butter which cannot be mistaken, however many the counterfeits on the market may be, and some information regarding its manufacture may be of interest to readers of this paper.

Devonshire butter is made from clotted cream, *i.e.*, cream obtained by scalding the new milk, which has been set twelve to twenty-four hours undisturbed, then heated up to 180° F., when a "crinkled surface" is obtained. This is then allowed to cool for twelve hours and the cream (clotted) is skimmed off. The necessary dairy utensils required for making Devonshire butter are exceedingly simple and inexpensive. These consist of a butter tub, a beater, a print, and a spoon, and the whole would necessitate an outlay of thirteen to fourteen shillings, or even less. The tub is well scalded and cooled with cold water before use, also the other utensils. The cream is churned perfectly "sweet" and fresh. 'Clotted" cream is never "ripened," and it is placed in the tub ready for the "operation" of churning into butter. The Devonshire butter maker is an adept at the work, and having her sleeves well turned up, with her right hand she stirs the cream round with considerable vigour in a circular way until the whole mass of cream is quickly converted into one mass of butter, the process taking from five to fifteen minutes of time. The time taken varies, of course, according to the season of year, amount of cream, thinness or thickness of same, and condition of cows yielding the milk from which the cream has been obtained. The butter-milk is then allowed to drain off by tilting the tub to one side, the milk running from the plug hole into a pail placed beneath. The butter is then washed in several waters, then dry salted in the tub, the salt being thoroughly worked in with the hand. It is then taken out in lumps and well "beaten" on the "beater" until all the moisture has been expelled. This "beating" process requires some considerable skill and dexterity, as every true daughter of Devon who has made butter by hand and tub well knows. When the butter is dry enough, it is made up (in the same tub as it was churned in) into rolls and prints according to the tastes of the consumer.

The great popularity of this method of producing real "Devonshire Butter" still lingers in many districts in Devon,

particularly in the north and south of the county; but technical instruction in dairy work has during recent years introduced the use of a wooden spoon instead of the human hand for churning "clotted" cream into butter. By this method the butter is obtained almost as quickly as with the hand, and as it is churned into small "grains," a far better washing is thereby assured, and a greater amount of caseous matter (which is characteristic of "clotted" cream butter) is got rid of during the washing process, several waters and brine being used. It may here be mentioned that, during the process of making butter by tub and spoon, a small quantity of "breaking water" is added at the stage when the granules of butter begin to form, a state well known to all experienced butter-makers who adopt the modern system of dairy practice. During the winter the cream is slightly warmed before turning into the tub—56° to 58° F. will be found a good average heat—and "Jersey clotted" cream at the lower temperature. The butter is dry salted in the granular state and then worked by the aid of a muslin cloth until all the moisture has been expelled. It is then worked with a pair of Scotch hands into the desired brick shapes in the tub. It will be found to be much firmer in texture than raw cream butter, and it is not, however, so clear in colour as butter produced from raw cream and churned in an ordinary churn. The best brands of butter produced from Devonshire cream, made by either of the systems mentioned above, will possess a flavour and aroma, rich and creamy, which is not found in any other class of butter, and will also keep better. At the recent Dairy Show of the B.D.F.A., some of the finest butter exhibited was of this kind, and justly earned the coveted honours which fell to the lot of the respective makers.—"The New Zealand Farmer, Stock and Station Journal"

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BACON CURING.

The accompanying illustration shows a simple plan of bacon curing practised in Canada. The house is made of two large packing cases of equal size, set one on top of the other and built over the end of a trench dug 18 inches deep, the same in width, and about 8 feet long. A low bank opening on to the level (a well dump) is just the thing. The lower box has its bottom and top knocked out, the upper one only the top. The bottom of the upper box has plenty of holes cut in to admit smoke and serves as a floor (shown by dotted lines) to prevent meat from falling into the dirt below. Bars are nailed within the upper box to hang meat from, nails being previously driven into the bars to serve as pegs. A third box might be added, with top and bottom removed, or even a fourth, to make more room if required. Two boxes 3 feet wide and 2½ square on the ends will be sufficient for the meat of two hogs. The uppermost box is capped, as shown, with a rough gable roof, open at the top and covered with

wire net to exclude flies; a rain board over the top. The trench is covered with pieces of old flattened stove-pipes or tin, and earth is banked over all and about the base of the house. A smudge of woodyard rakings, poplar or oak wood (discarding pine chips or dust, or anything with a rank smoke) is kept gently smoking at the mouth of the trench for about three or four days and nights. The smoke draws gently up the trench and through the house.

The following is a good recipe for dry curing which has been found simple and excellent. Saltpetre, 1 lb.; black pepper, 1 lb.; brown sugar, 3 lbs.; salt, 20 lbs. This is for about 300 lbs. of meat. Rub this mixture into the meat, stuffing all openings freely. Keep in a cool place for two weeks, examining and turning, and rubbing in remains of the mixture. Brush off, clean and smoke. Covering before smoking by sewing up in thin cotton bags will ensure cleanliness. Keep in a cool place for summer use.—"Pigs for Profit."

A CANADIAN BACON CURER.

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HOW TO KEEP HORSES HEALTHY.

The narrow dimensions of many stalls is a positive cruelty to the horse. They are built too narrow to enable him to extend his limbs when convenient. He is compelled, says an Exchange, when in a recumbent position, to double up his limbs under him and his legs are thus cramped when they should be completely at rest. Five feet is narrow enough for single stalls. Box stalls permit the animal to choose his position and change it at pleasure. Comfort is essential to health, and it is evident that the animal cannot be comfortable when closely tied to a narrow stall. The stall should be kept clean, and the floor daily sprinkled with some good absorbent to absorb the foul odours continually arising. Besides having pure air for the animal to breathe, a stable that is stored full of hay and grain ought to be

kept well ventilated and clean, that the impurities of the air may not penetrate them; all food should be kept as pure as possible. Cleanliness about the stable is just as important to the health of the horse as cleanliness about the house is important to the health of the family. Overcrowding in stables is another evil; the temperature of the stable is, in consequence, unnecessarily high; and the animals are thus likely subjects for disease. The conditions are still worse where there is no method of introducing fresh air, and the animals are compelled to breathe the same foul air for some length of time. It is only natural that horses taken out of such quarters into the colder outside air should feel the sudden change of temperature severely, especially horses that have been worked hard and whose constitutions are thereby the less able to stand such conditions.

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COCKERELS AND PULLETS.

As soon as the cockerels begin to spring their combs and try to crow in imitation of their elders, it is well to take them away from the pullets and put them by themselves. Of course this will necessitate shutting them up in some way, as otherwise, they will soon make their way back again. The best thing is to have a small orchard or a little paddock fenced off for the accommodation of cockerel chickens, so that they practically have liberty, although they are not unrestrained. To separate the sexes in this way will assist the growth both of cockerels and pullets, and it will be possible to run up the cockerels for market much more rapidly, for if they are left with the pullets neither of them will grow and develop as they would otherwise do. As a general rule, cockerels will grow and mature for market more rapidly than pullets; and, besides this, there is, as a rule, less hesitation in getting rid of a number of cockerels than in getting rid of pullets, because the farmer may want to keep his pullets a little longer in order to pick out those that are the most suitable to keep for laying.—"The New Zealand Dairyman and Farmers' Union Journal."

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CLEANING NEGLECTED IMPLEMENTS.

The following is a good plan for cleaning a plough, which will also work well, says an Exchange, on other tools of iron or steel. Slowly add one pint of sulphuric acid to one quart of water, handling it carefully and stirring slowly, as considerable heat will result from the mixing. When it is cool moisten the surface of the metal with this, and then rub dry, after which wash off with pure water. This application should clean any surface not too badly rusted, but if the tool has been long neglected it may require more than one application. After cleaning, a thorough coating of grease is given before putting the tool away.

TO GET RID OF WEEVILS.

The wheat bins of the farmers sometimes contain grain weevils, which become very destructive where grain is to be used for flour making of any kind, or for meal making. Where such insects are numerous, about the only way they can be got rid of is by the use of carbon-bisulphide. This can be applied to the bins by inserting a gas pipe and allowing the chemical to run to the bottom. No lamp should be around when this is done, as this chemical is very explosive in the presence of fire. Also, as soon as the carbon is inserted the bin should be covered tightly so that the fumes may penetrate every portion of the stored grain rather than escape into the open air.—"The Australian Horticulturist."

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TESTING EGGS.

There are many ways of testing the freshness of eggs, which are more or less satisfactory. "Candling," as it is called, is one of the methods most commonly followed. The eggs are held up in a suitable device against a light. The fresh eggs appear unclouded and almost translucent. If incubation has begun a dark spot is visible, which increases in size according to the length of time incubation has continued. A rotten egg appears dark coloured. Egg dealers become very expert in judging eggs by testing them by this and other methods.

The age of eggs may be approximately judged by taking advantage of the fact that as they grow old their density decreases through evaporation of moisture.

According to Siebel, a new-laid egg placed in a vessel of brine made in the proportion of 2 ozs. of salt to 1 pint of water will at once sink to the bottom. An egg one day old will sink below the surface, but not to the bottom, while one three days old will swim just immersed in the liquid. If more than three days old, the egg will float on the surface, the amount of shell exposed increasing with age ; and if two weeks old, only a little of the shell will dip in the liquid.—"The New Zealand Dairyman."

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CHARACTERISTICS OF GOOD FLEECE.

There are certain characteristics that all good fleeces should have, no matter of what type, that, says a writer in a New Zealand farmers' paper, do quite materially affect the price. It should be of uniform length for one thing ; one fibre should not be an inch longer than the one beside it, nor should there be patches on the body where the fleece is shorter than on other parts. Secondly, it should be uniform in size ; some fibres should not be coarse and some fine, nor should the individual fibres be small at the base and larger at the tip, or *vice versa*. Thirdly, it should be dense, for density prevents foreign material from penetrating and helps to retain the oil secreted, thus

making the fleece soft, not harsh, to the touch. Fourthly, it should be all of the same shade, lustrous and free from dead fibres. And lastly, it should be of uniform strength; one fibre should not be strong and the one beside it weak; nor should the individual fibres have weak places where it is likely to break. Now, of course, no wool is absolutely perfect, but all good wool possesses these characteristics in a more or less pronounced degree.

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PIGS FOR SMALL FARMERS.

There is one advantage about pigs which makes them emphatically the stock for the poor man or the small farmer, and that is the very quick returns which they afford by the rapidity with which they increase and come to maturity. A good brood sow, given good treatment, so as to be kept in a thrifty condition, will farrow two litters of pigs in a year that will run from seven to eight pigs in each litter; and if proper feed and care is given, these may be ready for market by the time they are eight or nine months old at the latest. No other stock kept on the farm will make so good a return in so short a time. Sheep will come nearest to it, but, in the same length of time, a pig will make double the weight of a lamb.

Another advantage with pigs is that they are marketable from the time they are farrowed until they are fattened for market. A sow with a litter of pigs, three, four or five months old, will always sell at full market prices; so that the farmer is not obliged to feed them to maturity to get a little money out of them. When it is considered that they utilise much on the farm that would otherwise go to waste, it is only in exceptional cases that a few cannot be kept on the farm with profit.—"The Farmer and Stock Breeder."

DIARY FOR FARM, GARDEN AND ORCHARD.

NOTES ON THE FARM.

By Alex Holm
(General Manager, Experimental Farm, Potchefstroom).

November.

Stock.—Stock should now be in an improving condition, and should be able to maintain themselves on the veld. They will, therefore, call for less attention, but all stock should be examined at least once a day. In the best managed herds and flocks troubles arise, and if attended to without delay the losses arising therefrom are lessened.

Calves will continue to be dropped. If they suffer from scour give a dose of castor oil, one to two tablespoons, according to age. A stimulant is also generally required. Whisky in a little milk serves well. If the trouble persists, repeat castor oil, and follow with doses of prepared chalk and a little flour given in a milk gruel.

Care should be taken not to allow bulls to run with the cows until such time as it is desired to have the cows served. Cows in good condition will often come "in season" a few weeks after calving, and if served would calve too early the following season. The period of gestation of a cow is from 9 to 9½ calendar months. The date of calving can, therefore, be regulated.

Now is the season for serving mares; the ordinary colonial mare should breed useful riding and driving horses if crossed with a thoroughbred horse. He should transmit breeding character, quality, stamina and fleetness to the progeny, and increase their market value.

A mare will generally "take the stallion" nine days after foaling, and in most cases she should then be served. If she does not prove in foal she will return for service about every three weeks afterwards. A mare carries her foal from 11 to 11½ months.

Crops.—On most farms this is the most important month for the seeding of crops. Kafir corn may be sown early in the month, and the sowing of maize should be completed with, perhaps, the exception of early varieties, or that to be grown for ensilage. The most desirable width for the rows is about 3 feet; the crop can then be cultivated with horse hoes, and sufficient air space for the growth of the plants is provided. The tall growing varieties might, perhaps, benefit by being in rows 3 ft. 6 in. apart, while the early varieties (generally less robust in growth) might be grown at 2 ft. 6 in. On very dirty land check rows are an advantage; the grains are then dropped in hills, generally at 3 ft. apart. The amount of seed required per acre varies according to size of grain. With rows at 3 feet apart, 12 lbs. of large grain, 10 lbs. of medium-sized grain and 8 lbs. of small grain is

sufficient. Efforts must be made to increase the yield of maize in this Colony without increasing the cost of growing. This can only be done by improved methods of cultivation and by growing the best varieties. The Department of Agriculture has introduced varieties which gives promise of largely increasing the yield. The desirability of manuring the maize crop is rather doubtful. Farmyard manure is only obtainable in limited quantities, and there is a great deal of labour involved in its application. On the other hand, artificial manures are expensive when the shipping and railway charges are added to the cost. Their application to crops giving a large return per acre is probably sound, but for a crop like maize, which is often not worth more than £2 or £3 per acre, the cost of a small application of manure may amount to a large proportion of the value of the crop. "Phosphates" are likely to be the only form of manure required, and if finely ground bone meal or guano can be procured at about £5 per ton, their application at the rate of 300 lbs. per acre might pay.

Other crops which may be sown this month are oats, manna, potatoes, pumpkins. In some districts summer oats apparently succeed, though in most cases they fail from rust. Early maturing varieties, suitable for growing in the summer season, are generally the most subject to rust. Manna may be sown in this and the following month; potatoes may also be planted during this and the following two months. Notes on these two crops will be given under December.

The harvesting of the winter grain crops will now be general. Care should be exercised in cutting, as the varieties of oats and wheat grown in this Colony easily shed their grain. Oats to be used for "forage" should be cut just when they begin to turn colour. If grown for grain they should be cut before they are ripe. They will ripen in the straw, and will not shed so much as when cut ripe. The same remark applies to wheat but to a less extent. The value of the reaper and binder for cutting grain crops should be better known. Some are apparently prejudiced against it. It is frequently said that the bundles do not dry so well around the string as hand-tied bundles. This is, however, entirely a fallacy. I have found that string-tied sheaves are more easily harvested than hand-tied ones. The cost of cutting and binding the crop with a reaper and binder is from 7s. 6d. to 10s. per acre. With it there is less waste than in cutting and tying by hand, the grain is shed less, and the bundles are better tied.

If the crop of wheat and oats is to be held over, open sheds are most suitable for storing it. It is doubtful whether thatch would keep out the heavy rains in this country, and it would also probably be blown off with the high winds. The roof of a stack can, however, be protected with a sail cloth, and if the roof is properly built little damage is done to the grain.

DECEMBER.

Stock.—Heat, flies, and ticks will now begin to be troublesome. More shelter for stock is required over a great part of this Colony. Clumps of trees should be planted in different parts of the grazing

land, and belts of wattles should be sown in localities where they will grow, to break the winds and give shelter from storms. If no natural shelter is available and there is plenty of stone in the district, useful shelters can be provided by simply erecting walls of stone; a roof, though useful, is not always necessary, as the animals will obtain a great deal of shelter from the wall itself.

The practice of "kraaling" stock at night and herding them during the day is not attended with the best results. Stock of all kinds, and especially sheep, thrive much better if allowed to find their own resting place and are not disturbed in their grazing during the day time. In order to do away with "kraaling," fencing must, however, be done, and this entails expenditure, but the expense will be sound economy, even if interest has to be paid on a loan to carry it out.

Crops.—The remainder of the maize crop should be sown as early as possible. Some early varieties can safely be sown in most districts till Christmas, but the yield of early varieties is seldom so high as that of late ones. Maize may also be sown this month for ensilage purposes. See article on Ensilage in the July, 1906, number of the "Agricultural Journal."

Mannas and millets should be sown this month. The true Boer manna is probably the best for making hay, and it grows a good crop. It, however, is somewhat later than other varieties. If grown for hay, 12 to 15 lbs. of seed per acre should be sown; if for seed purposes, 10 lbs. would be sufficient. Pearl millet grows an enormous crop of forage—up to 20 tons per acre—and would appear to be much appreciated by stock. It should be sown in rows about 1 ft. 6 inches or 2 ft. apart, and at the rate of 15 lbs. of seed per acre.

Root crops may be sown this month in districts where fairly frequent rains fall to carry the young plants beyond the critical stage. Mangold-wurzel is perhaps the best root crop to sow. Swedes and turnips are not to be recommended for the Western Transvaal, but it is reported that they do well in the Eastern district. Mangel growing should receive more attention, especially by stock breeders. They are most valuable in the winter season for ewes in lamb or ewes rearing lambs, and for young stock. For particulars of growing this crop see "Agricultural Journal" of October, 1904.

The spring crop of potatoes will be ready for raising and the summer crop may now be planted. When potatoes are planted or dug at this season of the year, great care should be taken not to allow them to be exposed to the sun for more than a few minutes. The strong rays of the sun appear to "blister" the skin and the tubers rot.

In growing potatoes the ridge system is, I think, preferable, whether the crop has to be irrigated or whether it grows with the rainfall. In the former irrigation is facilitated, and in the latter damage from an excessive rainfall is largely prevented. The rows should be from 2 ft. 4 inches to 2 ft. 6 inches apart, and the "sets" planted from 14 inches to 18 inches in the row, early varieties being placed at the closer distance. The land should be well cutivated with

a grubber or horse hoe to loosen it and to destroy weeds, and the crop should be well "earthed up." With a ridging plough this prevents so much damage being done by the potato tuber moth, which attacks chiefly those tubers lying near the surface.

The manures found to give the best results in potatoes are dung (about 10 tons per acre) and about 500 lbs. per acre of guano or bone meal. It is good policy to plant a small acreage well cultivated and well manured, rather than to plant a large acreage with little or no manure, and where the cultivations are not attended to.

In early districts, potatoes ripened in December can then be dug, stored in a cool place for a month, and be planted for the next crop in January. Early varieties of potatoes respond more readily to this system of forcing. Further information on "Potatoes and their Cultivation" appears in an article in this issue of the "Journal."

Weeds will be troublesome this month, and to be successful in keeping the land clean they should be dealt with as soon as possible after they have germinated. In their seedling stage a light harrow will destroy the greater part of them. Nearly all crops can be harrowed with safety, and a stirring of the surface soil does them good.

JANUARY.

Stock.—Grass should be plentiful, and all kinds of stock should be in a thriving condition. A daily examination of the herd and flock should, however, be made, so that any animal which exhibits any symptoms of sickness or unthriftiness can be promptly treated. Losses among stock are thus largely prevented by good management. Cows, being now in an improving condition, will take the bull freely. On ordinary stock farms, where winter milk is not desired, this is probably the best month for service to take place. The period of gestation of the cow being about nine calendar months and one week, the calves would be dropped in October. Careful observation should be made to ascertain whether the bull is proving to be a good stock getter. A proportion of the cows served generally return for service at 20 or 21 days after the previous service, but if this proportion exceeds 20 per cent. after the second service, another bull should be used on these cows if one is available. A full grown bull can be used to 60 cows during the course of a year, and may be allowed to run with about 40 cows during a service season spread over two or three months.

In large herds greater success will attend the practice of separating the bulls, and of placing with each a certain number of cows, than if the several bulls are allowed to run together with the whole herd. When the bulls have been with the cows for about six weeks, they should be interchanged from one lot to another. If all the bulls be allowed to run together, the "master" one will maintain sway to his own detriment, and to the detriment of the proportion of the cows found to be "in calf." In this connection, let me urge upon stock breeders the discontinuance of two practices which are so

detrimental to the improvement of stock, and the successful rearing of stock in this Colony:—

Firstly, the use of mongrel bred bulls—animals which possess no quality except that of hardiness, and which beget offspring which are neither uniform in type, nor do they possess any of the qualities of beef or milk production in any marked degree. Without disparaging the importance of a good dam, the influence of the sire, regardless of any question of prepotency, is fifty times as great, since his qualities are transmitted to 50 or more of his offspring in one season, whereas the character of the dam is only handed down in one animal. By the continual use of well-bred sires, inferior stock in other countries have been graded up to a high standard of merit, and with knowledge and enterprise the same result should even more rapidly be secured in this Colony, which possesses excellent foundation stock in its indigenous breed.

Secondly, the common practice of allowing cattle, young and old, to be reared together is one which has no defence in any herd where an attempt at sound and successful management is made. The absence of sufficient fencing, and the difficulties of watering stock on many farms, is to a large extent responsible for this practice in this Colony, but if stockbreeding is to become a source of profit to the owner, an effort should be made to overcome the difficulties. The castration of young bulls at an earlier age, and the grazing of the heifers apart from all bulls until they are at least two years old, will do much to remove this obstacle to successful stockbreeding.

Lambs born in August and September may now be weaned, and, if possible, should be given the best pasturage of the farm. On some farms good sweet herbage will be found on land which has carried a crop of grain, and on this lambs will thrive well.

Stock diseases peculiar to South Africa make their appearance this month, especially in the middle and low veld. Against horse-sickness, thanks to the investigations of Dr. Theiler, mules can be successfully immunised, and there is great promise that the inoculation of horses will be similarly successful.

Blue-tongue of the sheep is common in many districts at this season. A dose of 1 to 2 oz. Epsom Salts, the administration of gruel and milk to maintain the animal's strength, together with comfortable housing in bad cases, is calculated to reduce the mortality. Periodical wahing of the nostrils with Jeye's Fluid or other disinfectant is recommended.

The ordinary South African redwater, or, as is commonly termed, "gallsickness," is, fortunately, not accompanied by a high rate of mortality among cattle bred on a redwater veld. Among imported stock or cattle brought from an area where redwater does not exist, this disease is often fatal. The best treatment is to administer one teaspoonful carbolic acid (No. 1 pure) well shaken up in a bottle of raw linseed oil thrice daily while the "fever" subsists. In addition, if the animal refuses food give quantities of nourishing gruel or milk and always keep it warm and comfortable. In the convalescent stage give small repeated doses of Epsom Salts and tonics.

Crops.—Of maize a few very early varieties can be sown early this month, but the crop would be very small. Many varieties can also be sown early this month for ensilage.

Weeds should be destroyed by harrowing the crop in its early stages and when the weeds are still seedlings. This operation should be followed later by cultivating between the rows, not only to destroy weeds, but to conserve moisture. On very dirty land, "check rowing" is recommended, since cultivating between the rows can be performed in several directions.

Mangels.—On the middle veld these can be sown successfully up to the middle of this month.

Lucerne.—This is usually about the best time to sow this crop; it has the chance of becoming established with the summer rains which follow. It should on no account be sown on "foul" land; grass and weeds will destroy it before it becomes established. By sowing this month, an opportunity is afforded for thoroughly cleaning the land early in summer. It is important that the soil be brought into good condition by cultivation, and, if necessary, by manuring before the crop is sown. On good land, which is naturally moist, lucerne may be expected to grow fairly well without irrigation. On high lying soils which are rather poor in fertility, it will live throughout the dry winter, but it probably will not grow more than sufficient for stock grazing purposes. In this connection it is valuable, as it provides a bite of green food in the early spring before there is much grass.

From 12 to 15 lbs. of seed would be sufficient for one acre. Great care should be taken to secure seed free from "dodder." Lucerne should be sown on a firm even seed bed at about ½ inch deep, and not more than 1 inch. Harrowing after seeding broadcast on the prepared surface will ensure the seed being sufficiently covered; if drilled in, the coulters should be regulated accordingly.

Potatoes.—The crop for winter use should, in most districts, be planted this month. Particulars are given in an article in this issue of the "Journal."

Other Crops.—On the middle veld manna may be sown early in the month for hay. Another good hay crop is Teff grass, which has succeeded well in this Colony. It can also be sown this month, and should be ready for cutting about nine weeks after brairding. Particulars of this crop are given in previous issues in the Botanical Section of the "Journal."

Lupins.—This is likely to prove the best crop for "green manuring," and should be sown this month. It grows well in this climate, it is a good drought resister, and is not destroyed by frost. We are not yet able to speak with certainty upon its cultivation, but it is probable that about 80 lbs. of seed would be sufficient to sow 1 acre in rows about 2 feet apart. If sown in rows at this distance the crop affords facilities for cleaning the land by cultivating between the rows.

Trees.—This is a good season for planting trees. Varieties should be chosen suitable for the purpose required, and suitable to the climatic conditions in the district in which they are planted. They can be obtained at cheap rates from the nurseries of the Division of Forestry, and in the July, 1906, number of this "Journal," particulars are given of the different kinds, their prices, etc. These particulars have since been issued in catalogue form by the Department, and can be obtained, free of charge, on application to the Conservator of Forests, or the Editor, Department of Agriculture, Pretoria.

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THE GARDEN.

By Arthur Bester, F.R.H.S., Assistant Horticulturist, Ermelo Experimental Farm.

The High Veld.

November.

Sow any annuals this month for late blooming. Sweet-peas sown this month will continue to bloom well into the winter months, particularly if sown in a sheltered position.

Violets which have not been transplanted for two years or more should be taken up and divided. The best way is to divide into single crowns and plant out in rows or as an edging to beds. When these begin to grow, care must be taken to remove all runners as soon as they appear. I have this last winter had a row which was treated in this manner. These commenced blooming in March, and gave a continuous supply right through the winter to the first week in September. I also had a row from which the runners were *not* removed, and these did not bloom more than 6 or 7 weeks. It is useless to leave the runners on and chop off close with a spade in April or May. The great point is to throw all the vigour of the plant into the one crown.

A small sowing of cabbage, cauliflower and savoy should be made towards the end of the first week in this month. The sowing gives early plants which come in fit for the table about March.

It is well, at the time of sowing, to prepare the ground for the planting out, and not to leave it until the plants are ready to transplant. Dig the ground over a good spade deep, adding plenty of manure (not stable, unless well rotted). By preparing the ground at the same time the seed is sown, it serves two ends—first, all the weed seeds germinate and can be kept down with a scuffle hoe; secondly, when the plants are ready and a misty day comes along, there is no delay—the plants can be put in at once, and not, perhaps, left over until the next nice planting day, by which time they have probably become spindley and weak. Do not forget to put them right down to the first leaves. It is a fatal error to have a cabbage or cauliflower with a foot to

eighteen inches of stock between the ground and the head. The first good snap of frost goes right through that stalk and the table goes short of green vegetables the rest of the season.

DECEMBER.

Canterbury bells, campanula, dianthus, aquilegia, delphinum, carnations, and all hardy perennials and biennials, may be sown this month for transplanting in March. These should be sown thinly in boxes in some sheltered position. The heavy rains make it unwise to sow in the open ground. So much loss is caused through this, and I fear in some cases the seed is condemned as bad which, had a proper amount of care been exercised, would have given at any rate a 50 per cent. germination.

Whilst I am on this subject, let me advise all those who purchase seed before they are ready to sow it to put the packets in a tin—an oatmeal tin is best, with tight-fitting lid—also to place the tin in a cool cupboard. Certain seeds lose their vitality when exposed to warmth, whereas the placing in an air-tight receptacle in a cool place preserves that vitality.

Another sowing of cabbages, etc., should be made before the middle of this month. These should be sown thinly, so that good, stocky plants are produced. If possible, plant out where the early sun does not get them. That is on a western or south-western exposure. Winter vegetables should always, if possible, be planted so in this portion of South Africa. It is not the frost so much as the sun on the frozen plant which ruins it. The early rays of the sun may be good for some things but they are certainly not good for frozen plants.

All vegetables such as French beans, peas, radishes, etc., may be sown this month. It is advisable to make repeated sowings, so that as soon as the October sowings are finished a fresh supply is ready.

JANUARY.

Sow pansy, viola, penstemon and all the flowers mentioned in December. Do not cover the seeds too deep—$\frac{1}{8}$ to $\frac{1}{4}$ inch is ample for all small flower seeds.

Shirley poppy can still be sown in the open, but once it has germinated the plants should be kept growing with the help of a little manure. Horse litter placed around them on the surface is as good as any.

Gaillardias which are flowering freely should have the old flowers removed as soon as faded. These are inclined to seed too freely, and it comes much easier to cut off an old flower than to pull up a hundred or so seedlings.

Plant a few potatoes this month, about the 20th. These will stand in the ground through the winter and can be dug as required. Any good sort will make before the cold weather comes and kills the tops, but an early or medium early is perhaps the safest, although the yield is not so great.

A sowing of carrots, spinach, turnips, cabbage, lettuce, etc., should also be made this month. Most of these will stand through the winter.

Cabbage and lettuce should be sown in rows thinly, and after they are large enough to be handled, they should be planted out in rows 18 inches apart and 12 inches apart in the row. Make the ground rich with manure, and if the rainfall is uneven give plenty of water.

Carrots and turnips should not be sown on newly manured ground —they are liable to make forked roots and, further, they are much more subject to rot. The ground should be in fine tilth, with a fair drainage. If clayey, an addition of coal ashes to the bed—well worked in—will greatly assist the plants.

* * * *

THE ORCHARD.

By R. A. Davis, Horticulturist.

NOVEMBER.

Deciduous.—With this month comes the ripening of many of our early fruits. Possibly a few peaches (only a very few) have found their way to market during October, but November is the month in which the season's business in these fruits may be said to commence in earnest. Peaches and apricots should be obtainable, and prices are naturally high, as is always the case for good early stuff. The usual complaint with regard to early fruit is that it is early but not good, and sells simply on account of being the first of the season. With the introduction of varieties which has been going on in this Colony during the past four years, it has been found possible to secure some that are both good and early, as, for instance, amongst peaches, the "Peen to" or "Flat Chinese," "Waldo" and "Angel." All these ripen in order from October to December, whilst late in the latter month, or early in January, a long list of good peaches is available, including Abec, Royal George, Dr. Hogg, Constantia. In Apricots one may secure a good range in November, including Early Cape, Early Newcastle, Royal, Hemskirke, Will's Early. Nectarines usually ripen early in January to late in February, whilst Japanese Plums range from late November to early in March.

At the risk of being termed monotonous, I must reiterate more forcibly than ever the cautions and advice always advocated here with regard to placing these fruits on the market in an attractive manner. Fruit well packed is half sold, and sold for a good price instead of a poor one perhaps. It is pleasant to note that enquiries for fruit boxes for packing were last year fairly numerous; the writer has been assured by some farmers who packed fruit neatly and with care, that they received more than double the sum they ever before

handled for their crop—due simply to care in packing. It must be understood that this commences with, and depends on, good picking. Each specimen should be carefully picked (not torn) from the tree; the difference between picking and pulling may seem finely drawn, but just that difference often effects the profit in a fruit crop. Kafirs do not make good pickers unless caught early and properly trained. To pick a peach properly, one has often to give it a gentle twist in order to secure the stem, without which the keeping qualities of the fruit are at once impaired. In pulling, which I am afraid is pretty general, the stem is often left on the tree, the fruit thrown, not placed carefully yet quickly, in a box, and the seeds of decay set up in the shape of bruises, often so slight as to be unnoticed, yet full of power to harm. It is just as easy to do the thing properly, and as one man can pick a ton of peaches or apricots in a day without any undue exertion, it is as well to have the fruit picked, not torn from the tree.

The question of boxes has recently been solved by Messrs. Mosenthal Bros., Ltd., of Church Street, Pretoria, which firm has decided to stock clear pine cases of the following sizes:—

2 x 9 x 15, apricot and plum.
2½ x 12 x 18, plum and peach.
5 x 12 x 18, pear.
The California half-crate, containing 4 baskets, each holding 5 lbs. of fruit.
The California standard orange box.
The California standard apple box, 22 x 11 x 10.

Up to this season growers have been compelled to import from the Cape Colony. It is hoped, now that the facilities are at hand, that they will be made the utmost use of.

Citrus.—It is to be supposed that nearly all our oranges are harvesting now, and in many cases a nice young crop well on the way. Unless good rains have fallen, water may be given freely but not frequently. That means, when you irrigate your citrus trees do it thoroughly, so that the water may sink down to the lower roots, where it is wanted. After irrigation, the land should always receive attention as soon as animals can be used on it. A stirring of the surface with a cultivator or similar tool once in every three weeks, results in the retention of much moisture which would otherwise be lost by evaporation, and thus serves a manifold purpose—the saving of water which may be used for other purposes, the saving of the labour needed in more frequent watering, and the far better and more healthy condition of the root system generally.

It is to be hoped that in a few years' time the introduction and general planting of later varieties of oranges than are in use at present, will result in the extension of the fruiting season from April to December or January. The system of letting oranges hang on the trees for weeks after they are ripe is to be condemned. It is calculated to damage the tree physically, and whilst it is true a higher price for oranges always obtains in the later months, still the risks of

loss through windstorms and other drawbacks (including theft) have to be feared; and it may be better policy to sell a crop in July at 8s. per 100 than to allow the fruit to remain on the trees until November with the expectation of getting 16s. These figures are mentioned deliberately. The writer knows many growers have complained during last season about low prices for oranges; in some cases sales have been made at 2s. per 100. It only remains to be said that many others have sold at from 8s. to 10s. up to and during August. The main difference lay, not in the oranges, but in the packing.

DECEMBER.

Deciduous.—After last month's remarks about the picking and packing of fruit, one would think not much further need be said on the subject. It has been found, however, that this is a matter which has constantly to be kept before the public, which is rather remarkable when one considers that the packers of good fruit reap such a good harvest. An ideal should be aimed at in every industry. The point to be attained in fruit packing is, "when the time has arrived that your boxes of fruit sell on sight of the packer's name or brand, without any examination or opening." This cannot be achieved without personal supervision and watchful care over every operation from the picking of the fruit to the sale of same on the morning market. Much is needed, and will undoubtedly be supplied, by our railroad system as the need developes. Special refrigerator fruit cars will be a necessity, and each will have to be packed properly—a space for each box, not as at present; and, in addition, the rates on fruit will probably need revising, and the time in transit accelerating. Each package of fruit should bear the grower's name (brand if he has adopted one) and address, with the variety of fruit distinctly set forth, also the number of specimens contained in each box. Bear in mind, also, that once having built up such a reputation that your fruit sells on sight of your brand alone, if you should attempt to trade on that reputation you are on the high road to low prices. This means constant care to pack sound fruit, to send out only the best. A lost reputation is difficult to rebuild. Wherever possible grow your peaches, apricots, plums, etc., without irrigation. Too much water is usually given, and that is worse than none at all; it renders fruit large, but spoils texture, flavour and carrying qualities. It must, however, be borne in mind that if no water is given, frequent cultivation of the ground is imperative. Fruit which is produced under what is known here as dry cultivation is undoubtedly of the best quality; this being due to the fact that the trees receive enough but not too much moisture. Whilst this system of cultivation is carried out on all the experimental stations of this Department, the use of irrigation is far from being entirely condemned. Some parts of the Colony are frequently in sore need of water, and suffer from hot dry winds, which make evaporation extremely rapid. The judicious use of water in such cases is to be advocated; always make the work as thorough as possible and follow up with cultivation.

Summer pruning should, in those instances where it is necessary, now be undertaken. Instructions with reference to this operation may be obtained from this Department by applying for a leaflet on the subject.

Citrus.—On reference to last year's notes on this subject for this month, I find that the advice then tendered is fully as necessary to-day. True, in some few cases the writer has been gratified by having seen it followed, and those who have adopted the system of pruning then advocated are one and all pleased that they allowed themselves to be persuaded. These notes read: "Advantage should be taken of slack time to examine the roots of such trees as present a sickly appearance, and where disease is found the necessary remedy should be applied. All limbs brushing the ground should be removed, in order that light and air may be freely admitted. It is a good plan not to allow the lowest limbs to be within 18 inches of the ground." In addition, I would say that the ends of the lower limbs were in my thoughts when the above was written. This, in order that they may not touch the ground unless heavily laden with fruit. When this happens the branches do not fully recover themselves, always having a drooping tendency, and possibly coming down lower than they should. Remove the offending portions of these limbs with a pruning shears or knife, and gradually train the growth so that the space underneath the lower branches and around the trunk shall be open to the air. This treatment has been consistently advocated in these pages for the last four years, and will continue to receive the strenuous advocacy of the writer in season and out of season, until it becomes generally adopted.

Young oranges, etc., may now safely be planted.

JANUARY.

Deciduous.—This is the month of the year for Transvaal fruits, and orchard work consists principally in the gathering of them. Perhaps it would be as well not to say anything further about packing, etc., this month. It is meant, however.

In addition to our own supply, the larger markets are filled with fruits from Cape Colony, principally from the Western Province. These consignments must cease as soon as prices up here are no longer on a paying basis for long distance shippers. Our own growers have, of course, the advantage in the matter of freight, both in time and cost. With the object lesson constantly before them yearly, almost, one may say, daily, it is strange that more large plantations are not laid out in the Transvaal. If Cape growers can afford to pay heavy charges on freight, etc., and still find money in the fruit business up here, surely our own farmers can do as well or a little better.

Citrus.—This is also a good month for planting young citrus trees of all kinds. A much needed word of caution is given here with regard to two points which were noticed last season. Do not, in the first place, purchase any citrus trees, mango, etc., for shipment, loose, or with roots packed in moss; such trees should always be packed in

soil. The freight may cost a little more, but with trees packed in this manner the chances of losing even one tree in transplanting are reduced to a minimum. A further caution is needed with regard to the trees themselves. As often as not citrus trees are sent in from our neighbouring Colonies which are utter rubbish, often measuring not over 15 inches in height and composed entirely of first growth wood—in reality sap wood. These are accepted and planted in good faith, but with a couple of degrees of frost in the winter there is an end of them. This means loss all round, excepting to the railroad. The purchaser loses his trees and the transport costs, while the nurseryman loses his good name, and possibly is compelled to replace the trees in order to keep on good terms with his customer. So no one is benefited, and yet a good many people *will buy* small trees because they are low priced (but not cheap), and the nurseryman will supply small stuff because they can do it at £2 or £3 per 100 less than a well grown tree would cost. Now a fair price for first-class well grown citrus trees, ¾ of an inch in diameter at a foot from the ground, and not less than four feet in height, is 4s. each, packed in single tins and buying by the 100. The trees should be grown to a single stem and staked to keep them straight. This system is rarely practised, the usual tree one gets having already branched out in tree form in the nursery. Still, if you cannot get the kind of trees here described, insist, at any rate, upon getting the very best you can, and accept nothing under 3 ft. in height; look out for a good solid stem of well matured wood, and "see that you get it." A fair price for such trees as are usually described as first-class and answer the latter description, would be £15 per 100. One item futher may be mentioned, and that is, you may buy now any kind of fruit tree grown in South Africa without any risk of getting any disease with it. The Ordinance for preventing the spread of insect pests and plant diseases now in force, and administered by the Entomological Division, is one of the greatest safe-guards against obtaining diseased trees.

EDITORIAL.

TRANSVAAL AGRICULTURAL UNION.

The Annual Conference of the Transvaal Agricultural Union was held in the Town Hall, Pretoria, from the 10th to the 13th July last, and was numerously attended not only by the delegates of affiliated Agricultural Societies but by the general public interested in farming questions and by the Director of Agriculture and officers of the Department. At the opening sitting H.E. the High Commissioner was present. The chair was occupied by the President of the Union, J. E. van der Merwe, Esq., of Potchefstroom, who, in concluding his opening address, said :—

"There is still much to be done before the position of the farmer can be greatly improved. The principle of co-operation must be extended into every branch of our Agricultural industry. Scientific research into the causes and prevention of stock diseases will have to be prosecuted with even greater vigour. Our products must be protected in such a manner as to enable the farmer to make some return upon his expenditure of capital and labour. Our staple crops must be improved and markets found therefor. Importation of agricultural produce, which can be locally grown in sufficient quantities, must be brought to an end by the adoption of up-to-date methods. Our crops must be insured against loss from hail and locusts. The abundant rainfall with which we are blessed must no longer be allowed to find its way unchecked to the sea. Agricultural education must form a part and parcel of our school curriculum, and Industrial Schools must be multiplied as they are found to be necessary. The ravages of locusts must be combatted on uniform and common-sense lines, and our best energies must be devoted to the overcoming of the many difficulties with which we have now to contend."

A distinguishing feature of the first day's proceedings was the address delivered by Lord Selborne. The sound practical advice, no less than the inspiriting tone of encouragement which pervaded His Excellency's kindly address were equally appreciated by his audience, and afforded an additional proof, if that were needed, of Lord Selborne's constant and sincere desire to do all in his power to promote the vigorous development of the agricultural and pastoral industries of this Colony.

Mr. A. C. Lyell, of Bloemfontein, in the course of an address upon the position and aims of the Wool Co-operative Export Union, which has been successfully established in the Orange River Colony, said that the result of the test shipment of wool sent during the past season has shown that in very many cases at least 2d. per lb. more was received by the seller than he had expected to get. The total cost of shipment from the time the wool left the farmer's hands, inclusive of all freights, commissions, insurance, etc., had worked out at from 1¼d. to 1¾d. per lb.

Resolutions were passed in favour of co-operative enterprise, the preservation of primeval forests, and the construction of railway lines through important agricultural areas, so as to bring the producer and consumer into closer touch, with a view to reducing the present high cost of living. Inspection of foodstuffs, seeds, and manures by Government was advocated. The Executive Committee was instructed to approach the Government with the object of securing that a further supply of thoroughbred sires should be available to stand at a minimum cost to the farmers ; and with regard to markets, it was urged upon the Government that agricultural markets should be placed under a Board composed of agriculturists and merchants, and not remain under the sole control of Municipalities.

It was further proposed that a Central Laboratory should be established and supported by all British Colonies in South Africa, in which competent experts should be employed to investigate the diseases peculiar to stock in South Africa. Combined action on the part of all the British Colonial Governments in South Africa for the destruction of locusts was strongly urged, and the Government was asked to establish an Experimental Ostrich Farm so as to place information and suitable stock within the reach of farmers desiring to embark upon the industry.

In respect to the proposal to insure stock and crops, Mr. W. T. Taylor was asked to attend and explain what was required. This he did and it was decided to endeavour to secure the statistics necessary to enable a basis to be arranged upon which such insurance could be effected. Mr. Taylor was thanked for his attendance and for the information verbally given. He promised to forward his views to the Secretary, in writing, in the course of a few days. They are as follows :—

1. It is essential to know the extent of ground in each district under cultivation and what crops are grown thereon.

2. The estimated value per acre of each crop, say, of mealies, Kafir corn, wheat, barley, oats, tobacco, etc.

3. What are the possibilities of recovery of the crop after a hail-storm has passed over ?

4. What is the average amount of damage in each district, say, over a period of five years, either by hail or locusts ?

If the Agricultural Union could take steps to obtain such statistics, he had no doubt that arrangements could be made that, in the near future, the farmers' crops could be covered by insurance policies.

Approximate dates of shows were arranged as follows :—

Volksrust.—Beginning of March.
Ermelo.—End of February.
Carolina.—First week in March.
Klerksdorp.—Third week in April.
Potchefstroom.—25th April.
Lydenburg.—First week in February.
Heidelberg.—Last week in March.

Standerton.—20th March.
Barberton.—Last week in June, or first in July.
Zoutpansberg.—Tuesday and Wednesday following Whit Monday.
Pretoria.—Middle of May.
Other shows.—At the option of the Executive.

The proposed Land Bank and a forward Irrigation policy were favourably considered, and Committees were appointed to give evidence on behalf of the Union before the Land Bank and Irrigation Commissions.

A paper was read by Dr. Theiler on the work done during the past year at the Bacteriological Laboratory generally, and more especially on the results of the experiments in connection with horse sickness inoculation in practice. Mr. C. B. Simpson, Government Entomologist, lectured on Locusts and Locust Destruction, and Mr. C. D. H. Braine, Secretary to the Irrigation Commission, read a paper on Irrigation in the Transvaal, the thanks of the Conference being accorded to these gentlemen for their instructive addresses.

It was decided that the next annual conference be held in Pretoria in July, 1907.

The following were elected office-bearers for the ensuing year: —President, Mr. J. E. van der Merwe; Vice-Presidents, A. H. Malan, Dr. Gunning, G. Redpath, A. G. Robertson, H. J. Wentworth, D. J. E. Opperman, F. B. Smith, M.L.C., Director of Agriculture; Hon. Vice-President, Louis Botha; Hon. Life Member, I. van Alphen; Hon. Member, Major Huneberg; Executive Committee, H. J. A. Wentworth, R. B. Barron, A. G. Robertson, H. A. Baily, A. H. Malan, L. Bagshawe-Smith, Major Bolton, R.M., C. H. Zeederberg, I. van Alphen, H. Cornforth, A. Smuts, J. H. Moodie, P. N. Maskell, P. van Dyk, J. L. van Heerden, T. Everard, M.L.C., E. J. Bourhill, W. P. G. Macpherson, J. E. van der Merwe, W. L. Dagg, M. Riekert, Capt. Baker, M. Mulder, F. W. Jooste, J. D. Kent, Capt. Madge, Capt. H. S. Parry, J. J. Enschedé, A. F. van Gass, E. N. Thompson, J. C. Brink and D. Forbes.

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INTER-COLONIAL LOCUST DESTRUCTION.

Government Representatives from the several British South African Colonies assembled in Conference at Pretoria on the 20th and 21st of August last, on the invitation of His Excellency the High Commissioner, with the obect of devising some scheme of joint Inter-Colonial action for combatting the locust pest.

Amongst those present were: His Excellency the Earl of Selborne, G.C.M.G.; Mr. Adam Jameson, M.L.C., Commissioner of Lands; Mr. F. B. Smith, M.L.C., Director of Agriculture; Mr. C. B. Simpson, Government Entomologist; Mr. C. P. Lounsbury (representing Cape Colony), Mr. C. Fuller (representing Natal), Messrs. C. N.

Johnson and R. Dumaresq (representing the Orange River Colony), and Mr. L. Wroughton (representing Basutoland). The Hon. Joseph Baynes, the well-known Natal farmer, was also present as a visitor.

"Gentlemen," said Lord Selborne in the course of a short speech of welcome to the delegates, a speech which so exactly declares the enlightened opinion of the farming industry, now, happily, the prevailing opinion, as to render further comment elaborate and unnecessary, "this year we have again, I believe, through South Africa—certainly in the Orange River Colony and in the Transvaal—been visited by the devastating scourge of locusts. I doubt, from what the old inhabitants of the country tell me, if a worse year has ever been known. It has, at all events, reminded us what a terrible anxiety the existence of this scourge is to the agricultural industry of South Africa and how it may jeopardise the results of the farmer's most careful provision and most assiduous labour just at the moment when he expects to reap the results of his long toil and industry. If the locust could be removed from South Africa, the gain to the wealth of the country is almost beyond our calculations. I am told by some people that it is a scourge with which men cannot deal, but I do not believe it. Gentlemen, I am perfectly convinced—it may seem a rash thing to say—but I am perfectly convinced from my own little experience of South Africa that it is not beyond the power of men to deal with it. It is quite beyond the power of the individual man to deal with, or the district or the Colony. It can be dealt with only by South Africa acting in unison for the purpose."

His Excellency then withdrew and Mr. Adam Jameson was voted to the chair. An exhaustive agenda had been prepared and the discussion continued throughout the day. The next morning the Conference having sat in Committee to consider the terms of its report, on the chair being taken, the following thirteen resolutions were formally put and agreed to, and the Conference rose :—

I.—Proposed by Mr. Smith, seconded by Mr. Lounsbury : That this Conference recommends the immediate establishment of a central bureau to be maintained for a period of not less than five years for the collection, tabulation and distribution of reports of locust swarms throughout the whole of British South Africa.

II.—Proposed by Mr. Smith, seconded by Mr. Simpson : It is recommended that the Governments of Portuguese East Africa and German West Africa be invited to co-operate.

III.—Proposed by Mr. Smith, seconded by Mr. Simpson : It is recommended that the bureau shall be under the direction of a Committee composed of one representative from each contributing Colony or Territory.

IV.—Proposed by Mr. Smith, seconded by Mr. Lounsbury : It is recommended that the bureau be located in Pretoria, and that the funds contributed to its upkeep be administered by the Director of Agriculture of the Transvaal.

V.—Proposed by Mr. Smith, seconded by Mr. Dumaresq: That the Committee shall hold an annual meeting at a time and place to be agreed upon by a majority of the members. An extraordinary meeting of the Committee may be held at any time at the request of two or more of the contributing Colonies or Territories. Three members shall constitute a quorum at any meeting.

VI.—Proposed by Mr. Smith, seconded by Mr. Lounsbury: It is recommended that the cost of the bureau, which shall not exceed £500 during the first year, be borne by each Colony or territory in accordance with the recognised scale.

VII.—Proposed by Mr. Smith, seconded by Mr. Fuller: It is recommended that each Colony make arrangements for collecting information regarding the position and movements of swarms of locusts within its borders, and that it transmit the same with all possible despatch to the bureau, together with any details that may be available.

VIII.—Proposed by Mr. Smith, seconded by Mr. Dumaresq: It is recommended that the bureau receive and tabulate the information so forwarded, and from time to time as may be deemed necessary issue maps and memoranda to each Colony or Territory concerned, shewing the latest position and probable movements of swarms of locusts, and further furnish, when possible, any special information desired by any Colony or Territory.

IX.—Proposed by Mr. Dumaresq, seconded by Mr. Smith: That this Conference expresses itself in favour of locust legislation on the lines adopted in Natal.

X.—Proposed by Mr. Dumaresq, seconded by Mr. Simpson: That in the opinion of this Conference the chief measure of control is in the destruction of locusts in the wingless or voetganger stage, and this Conference urges upon the Governments of the various Colonies and Territories to take steps to make the ease and low cost of destroying locusts by the sweetened arsenical solution universally known to farmers in locust-infested regions. Further, this Conference wishes to add that from the experience of the members composing it, despite the highly toxic properties of the solution, very little danger has resulted or is likely to result from the general adoption of this treatment to poultry, stock or man.

XI.—Proposed by Mr. Dumaresq, seconded by Mr. Smith: That this Conference is strongly of opinion that each of the South African Colonies or Territories should take measures to as far as possible ensure the prompt destruction of all voetgangers hatched out within its borders.

XII.—Proposed by Mr. Dumaresq, seconded by Mr. Simpson: That in the opinion of this Conference it is necessary that, in order to secure the general destruction of locusts qualified officers should be employed under each Government, and controlled by the Department of Agriculture of such Government, to demonstrate to the farmers in every infected area the measures recommended.

XIII.—Proposed by Mr. Dumaresq, seconded by Mr. Smith: That owing to the immense loss to the Transvaal and the Orange River Colony caused by the ravages of locusts hatched in Griqualand West and Bechuanaland this Conference strongly represents the importance of action on the part of the Government of Cape Colony in dealing with the pest in those parts of its area.

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THE BARBERTON SHOW.

The eleventh show of the De Kaap Agricultural Society was held at Barberton on Friday, July 5th, and was opened by the Director of Agriculture, who, in response to the Resident Magistrate's welcoming speech, referred to the successes which had been gained by Transvaal fruit growers at the Exhibition in London last June, and expressed regret that, owing to the date not being suitable, the Barberton growers had not been represented. The Director spoke hopefully of the prospects of an export trade in fruit and tobacco, and referred with satisfaction to the new Customs Tariff and the revised railway rates, both of which would afford material relief to the Transvaal farmer.

"Speaking generally," "The Gold Fields News" says, "the present year's show was, as had been anticipated, distinctly poorer than in former years, though in many of the classes, while the number of entries was less than usual, the quality was well maintained. In produce there was very little to commend, save the potatoes. There were seven entries of coloured potatoes and two of white, and in every case the quality was good. The sweet potatoes were very fair. The mealies were disappointing, for there was only one really good sample —a bag of white mealies. The forage classes, considering the drought, were fairly well represented, and the exhibits were of fair quality. A novelty was an exhibit of Teff, a new forage plant, grown by Messrs. Winter Bros. from seed supplied by the Agricultural Department.

"The feature of the show was undoubtedly the fruit, and it afforded the redeeming feature in what was otherwise a rather uninteresting exhibition. The bananas were small in quantity but of fair quality, though not as good as in former years. Pineapples were naturally not plentiful, as it is too early for the winter crop, and those shown were not at their best. The pawpaws shown were all green, but they promised well. Oranges were really good. One navel orange was weighed and turned the scale at 20 ozs.—quite a respectable figure, though it is true that at other shows fruit scaling 27 ozs. has been on exhibition. Naartjes were plentiful and good in quality throughout, both tangerine and mandarin, though many were slightly spongy owing to it being late in the season for this fruit. Lemons were good, and some specially fine samples of the Spanish lemon were

shown. Limes drew two exhibits, both very fine. The loquats were poor. Many classes were not represented, including apples, strawberries, pears and avocado pears.

"It must be admitted that the show of vegetables was poor, with the sole exception of tomatoes, in regard to which one of the judges remarked that he had never seen better. The number of entries was large and the quality good all round.

"It was gratifying to note that the poultry were put on the show in better condition than last year, the toilettes of the birds having received some attention, but, in most cases, the coops employed were far too small to exhibit the points of the birds. The sheep exhibited were few in number but included some excellent specimens of half-bred Persians and Merinos.

"Outside the hall in front was collected the exhibit of the Forestry Division consisting of 210 tins of seedling trees. Here a most encouraging feature was the number of seedlings shown from the local nursery in Concession Creek, there being in all 19 varieties, and two or three specimens of each kind were on exhibition, nearly all of which were sold at the conclusion of the show."

We should like to add that at one time the prospects were so disheartening, owing to drought and hail, that it really looked as though the show would have to be abandoned. The final resolve not to be beaten, but to make the best of things, was plucky, and the result in all the trying circumstances was a decided success on which we offer our congratulations to all who contributed to achieve it.

The show was attended by several of the Experts of the Department of Agriculture, who, with the Director and Mr. F. T. Nicholson, Secretary of the Transvaal Agricultural Union, met a number of farmers in the evening when a variety of subjects of interest to the farming community were discussed.

CLOSER SETTLEMENT.

Amongst the papers contributed to this number of the "Journal" will be found one by Mr. H. Rose-Innes, the Resident Magistrate of Pretoria, in which the possibilities of closer settlement on the Crocodile River are considered. Consideration and discussion of such projects are particularly opportune at this time, since it is generally agreed that definite action must be taken without any delay beyond what is absolutely necessary in the matter of dealing with the problem of indigency amongst a certain class of the white inhabitants of this Colony. That the Government realise that this serious social evil is not becoming easier of removal by the process of deferring the application of a remedy may be deduced from the appointment, within the last few days, of a Commission with a reference extending over the whole subject. Mr. Rose-Innes does not suggest any heroic

measures to combat the problem of poverty ; he merely offers a piece of plain practical advice which, put in plain English, is—back to the land. That advice will, no doubt, be accepted, mainly because so far as the present generation is concerned there is nothing further to be said ; it is the only practical remedy. Whether such advice will hold good for the next generation it is part of the duty of the Indigency Commission to enquire. At any rate, the advice is sound to-day, the more so in a Colony where the high cost of living offers a peculiar stimulus to agricultural production, and where the desertion of the poor white class from the land has been, in the case of the vast majority of them, merely temporary or occasional.

Incidentally, Mr. Rose-Innes' paper directs attention to the inadequacy of the statutory irrigation law of this Colony, which is particularly apparent at a moment when people are looking to irrigation on a scale hitherto unthought of as a main factor making for increased agricultural prosperity. No real progress, however, can be made in that direction until we have a comprehensive law which shall embody all the provisions which experience has shown to be necessary to enable modern methods of farming to be grafted on to an antiquated agricultural system. Amongst such provisions would be ample but well-guarded powers of expropriation by the Executive Government and the erection of an effective and economical system of local administrative control of irrigation projects undertaken with Government aid.

While, however, the irrigation policy which will ultimately be submitted for the approval of the people of this Colony is maturing under the guidance of the Irrigation Commission, Mr. Rose-Innes has put forward a practical suggestion that a certain tract of cultivable land, running into many thousands of acres, should be made available as an Irrigation Settlement by the construction of a large reservoir at Crocodile River Poort, or, as it is also known, Hartebeeste Poort, in the Pretoria district. This project, from the purely engineering point of view has, we learn, received the support of such well-known local engineers as Messrs. Karlson and Struben, and, finally, a no less authority than Sir Benjamin Baker has stated that provided the mountain formation, which has not yet been tested, is found capable of withstanding the strain, there is nothing impossible in the scheme.

We hope a project of such promise and importance not only to the indigent in our midst, but to the intending emigrant from beyond our borders, will not be allowed to die still-born for lack of enquiry and discussion. It is a project which deserves the attentive consideration of engineer and economist alike.

* * * *

REDUCTION OF THE NATIVE TAX.

The Native Tax Amendment Ordinance which passed through the Legislative Council last August, affords substantial relief (to the

extent of one-half the tax) to two considerable sections of the native population, the farm labourers and natives resident in Municipal Locations.

As regards the farm labourer the case for reduction has long been urged, not only by the farmers themselves, but by many to whom the unsatisfactory position of the rural labour supply was familiar, and who, therefore, desired in the general interests of the Colony, to see the Agricultural Industry placed in a position to compete against the superior attractions of the goldfields on something like even terms.

Now that the farmers have gained their point, and a substantial inducement to seek work on the land has been offered to the natives, we hope employers of farm labour will avoid the mistake of attempting a sweeping reduction of wages. We would urge such employers to allow the supply time to grow plentiful, and not to throttle it untimely in a vain attempt to make it cheap. When supply exceeds demand, wages fall by their own weight, as it were, and in the meanwhile the less interference with this natural economic process the better.

The remission of 50 per cent. of his direct taxation to the native resident of Municipal locations is but the recognition of the claim to relief which is justly put forward by natives who have to pay rents to the Municipalities for the land they occupy and for the Municipal services which they enjoy. Of greater significance is the encouragement, slight it may be, but still practical, which this remission offers to the town native who has found congenial employment, to release himself from the ties of the communal life of his kraal and take his place in the increasing ranks of the permanent unskilled labour force of the Colony.

* * * *

COTTON GROWING IN PORTUGUESE TERRITORY.

The Portuguese Government has recently issued a decree relating to the acquisition of land for the purpose of cotton growing in Portuguese Colonies. The terms upon which land can be obtained seem decidedly generous, and, if climatic conditions are favourable, should do much to encourage the industry. The actual rent at which land can be taken up works out at a little less than ¼d. per acre per annum, with a maximum concession of 1,000 hectares or 2,471 acres for any one leaseholder. There are large tracts of Government lands in the district of Lourenço Marques along the banks of the Maputa, Inkomati, and Umbelusi rivers, which are stated, and their appearance seem to confirm the statement, to be very suitable for cotton growing; and the same formation appears in the district of Gaza along the Limpopo River and in the district of Inhambane. Wild cotton occurs in all these districts, but it has no commercial value. It seems a pity that the law was not made applicable to the acquisition of land for the culture of rubber and fibres, for both of which the soil

and the climate are reported suitable. In consequence of favourable seek to confirm the statement, to be very suitable for cotton growing; the rent for a tract of land for growing rubber remains at about 30 times as much as would be required in the case of the former. Under the decree, cotton raised in Portuguese Colonial possessions is exempted from export duty in the country of origin, and also from the inport duty payable on cotton landed in the Kingdom of Portugal.

* * * *

TRANSVAAL TOBACCO IN THE BRITISH MARKET.

The following extract from "Country Life" for 1st September is interesting as showing that the merits of Transvaal tobacco are beginning to be recognised in England:—

There seems to be little reason why one of the paying crops of the future in the Transvaal should not be tobacco. Many and many a one during the late war learned not merely to smoke, but also to like, Boer tobacco, with its clean taste on the tongue, which in some way resembles that of Caporal. Besides which it is claimed that this country can do better; that it can grow a still better class of tobacco than we have yet learnt to associate with its name. At present Boer tobacco is slightly over the price that the average man cares to pay, for be it remembered that all these very dry tobaccos are rather wasteful; but once one or two recognised brands become familiar to us at fair prices, it will be surprising if a great many smokers who find the amount of sweetening matter rather too preponderating in tobaccos from another part of the world, do not gladly begin to smoke South African tobacco, and, having done so for a short time, make a practice of so doing.

* * * *

"PUMPING PLANTS FOR FARMERS."

Two corrections have to be made in Mr. G. O. Strachan's informative article on "Pumping Plants for Farmers" which appeared in the July number of the "Journal."

Page 763, paragraph 6, last sentence, reads:

> "This quantity will be contained in a circular corrugated iron tank of the usual type 4 feet high and 3½ feet in diameter."

This should read as follows:

> "This quantity may be contained in a circular corrugated iron tank of the usual type about 9 feet in diameter and 6 feet high, or in two tanks about 6 feet high and 6 feet in diameter."

Page 764, paragraph 4, reads:

> "A small windmill of, say, 8 feet diameter wheel on a tower of about 30 feet high would pump the 2,000 gallons *550* feet high."
>
> *550* feet is wrong and should read *50* feet.

"BLOOMFIELD."

In Fig. 2, Plate CXLIII., we reproduce an excellent photograph of the celebrated stud ram Bloomfield, recently imported by the Department of Agriculture, and now at the Experimental Farm, Ermelo. Bloomfield's pedigree follows :—

No. 1 on horn, 18 in. ear, Bloomfield Stud Ram, lambed October, 1903, name Bloomfield.

Sire, Bingham by Banker III.
By Banker II., by Banker I.
By Banker, bred by W. H. Gibson, Tasmania.
Dam, Bloomfield Stud Ewe.
Sire, Nelson I., by Nelson, by President.
Bred by Hon. James Gibson, Tasmania.

Bingham was shown two years in succession, was never beaten, winning 16 1st prizes and 6 championships. Bingham was shown six times in 1905, winning 6 1st prizes.

* * * *

THE GOVERNMENT TOBACCO FACTORY.

As will be seen from our advertisement pages the Government is now offering for sale Tobacco, Cigars, Cigarettes and Snuff, manufactured at the Government Factory, Tzaneen, Zoutpansberg District. We have sampled some of these lines and must say that we find them of excellent quality, and as the preparation of the various articles is gradually improved they should become very popular. Everything, except the cigar wrappers, is made from Transvaal tobacco and an encouragement is thus being given to the growth of one of our most important products. In fact, we understand that there has never been so much tobacco planted in the Northern Transvaal as there is at the present day. We hope that, as the result of the experiments and investigations now being made by the Government, factories on co-operative lines will be established in different parts of the country in the near future.

* * * *

SCENES ON TZANEEN ESTATE.

In Plate CXLIV. are grouped four scenes on the Tzaneen Estate, of which we append a brief description :—

"Native trees on the farm."—The tall tree in the centre is a rare specimen of *Anthocleista insignis*. The bark of this tree is eagerly sought for medicinal purposes by the natives. A sample of the bark, etc., is being sent to England to determine its actual medicinal properties and commercial value.

"Field of Florida Velvet Beans."—An experimental plot, about five acres, was planted with this bean. It is a heavy cropper and the

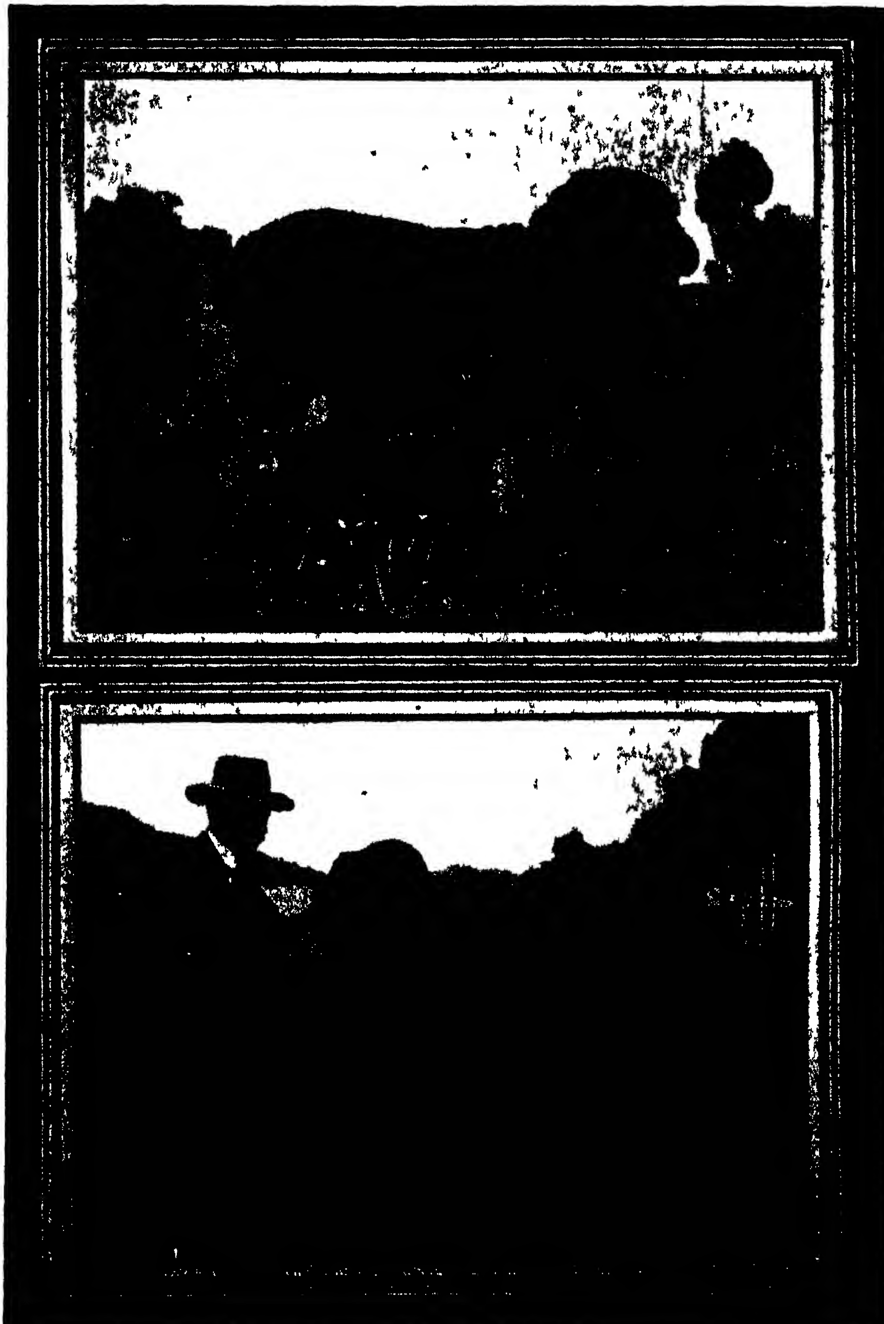

Plate CXLIII

Fig 1 **Stud Ewe,** lambed September, 1904 Sire Relic by Resemblance by President Latter was sold at Sydney Sales for 1,600 guineas Dam Bloomfield stud ewe by Banker III Bred by W H GIBSON Tasmania Shown at Narrabri in pen of three ewe lambs, 1905, taking 1st prize Shown in August 1905 Imported by the Department of Agriculture

Fig 2—**Stud Ram,** Bloomfield Imported by the Department of Agriculture (For particulars see note in Editorial Section)

Plate CXLIV

Scenes on Tzaneen Estate.

haulms attain considerable size. It is an excellent fodder for animals and should be cut and dried when on the green side and fed sparingly. For green manuring the velvet bean will play an important part in this country.

"Persian Sheep."—Hitherto the only varieties to thrive at all well in the valleys of the low country have been the Kafir sheep and goats. Last season an experimental flock of Graded Persian Sheep was imported from the Cape Colony. They appear to be free from blue-tongue and not susceptible to it. After the next lambing season it will be clearly seen whether the experiment will be a permanent success.

"Picking Cotton."—Cotton is being grown on the estate to prove its commercial value as a crop in this district, and, so far, the results attained have been extremely gratifying. This season about 40 acres were sown, and next, it is proposed, after eliminating certain varieties which do not lend themselves to advantage here, to increase the acreage and so form the nucleus of a new industry for the Colony.

* * * *

AN OPENING FOR DAIRY FARMERS.

We hear on excellent authority that there is a remarkable scarcity of fresh milk at Lourenço Marques. Apparently the supply from local sources is quite inadequate; such an opportunity is too good to be lost, and we suggest that some of our High Veld dairy farmers might do worse than run down to Delagoa Bay and make a bid for the fresh milk trade of our nearest port.

* * * *

THE NEW RAILWAY RATES ON FARM STUFF.

The rates on Grain and Forage grown in South Africa have been reduced over the lines of the Central South African Railways from approximately a 1d. per ton per mile to ¾d. per ton per mile. Subjoined is a table shewing several distances and making a comparison between the former and the reduced rate.

Miles.	Former Rate per ton. d.	New Rate per ton. d.
25	40	37
50	80	62
75	80	78
100	100	92
125	140	99
150	160	113
175	180	131
200	200	150

The above rates refer to South African Grain, Forage, Salt, Manures and Guano.

In connection with the Forage, the condition as to the four-ninth's carrying capacity of the truck in order to ensure that consignments are properly pressed is still maintained, but, in the case of Potatoes, the 10 ton minimum has been waived.

With reference to South African Fruit, Butter, Cheese, and Tobacco and Vegetables, the rates have been reduced as follows :—

Miles.	Former Rate per 100 lbs. d.	New Rate per 100 lbs. d.
25	3	2
50	4	4
75	6	6
100	8	8
125	10	10
150	12	11
175	14	13
200	16	15

The former regulations governing this traffic have been slightly modified. In order to secure the lower rate, the produce has to be consigned direct from the factory or place of production and a certificate to such effect has to be handed in.

In connection with small packages of South African Produce, Butter, Eggs, Flowers, Honey, Plants, Potatoes, Poultry (dressed), Tobacco, Trees (Plantation and Fruit), and Vegetables, consigned by passenger train, the charges on a 50 lb. package consigned over the following distances have been reduced as follows :—

Miles.	Old. s.	Old. d.	New. s.	New. d.
25	0	9	0	9
75	1	3	1	0
100	1	9	1	6
150	2	3	1	9
200	2	9	2	3
300	4	0	3	0

With regard to the forwarding of all the above traffic, no alterations have been made in the regulations governing the conditions under which the same may be sent forward at the South African or Preferential Tariff, except (as set out in the foregoing) in the case of Forage, Butter, Cheese and Tobacco consigned by goods train.

* * * *

AGRICULTURAL IMPORTS AND EXPORTS.

We publish in this number of the "Journal" a statement of quantity and value of goods relating in any way to Agriculture

imported into the Transvaal during the year ended 30th June, 1906, compared with the year ended 30th June, 1905. Following these figures a similar comparative statement is given of our exports for the same periods.

Since the supply of statistical information on the subject of imports and exports has been only recently undertaken by the South African Customs Statistical Bureau, it has been found necessary to extract the figures given in the statement from two separate sources. The classification also is not identical, and the figures must, therefore, be regarded as approximate. It should also be noted that since the figures of the South African Customs Statistical Bureau have reference only to goods on which Customs have been paid, the "duty free" importations of the Army are not taken into account.

The value of the imports relating to agriculture during the financial year 1905-6 exceeded those for the previous year by no less than £482,000 (in round thousands), the total value being £7,442,930.

Among the principal increases we find :—Animals, living, £195,000 ; Fodder and Forage, £63,000 ; Cotton manufactures, £166,000 ; Butter (including Ghee and substitutes for butter), £25,000 ; Jams and Jellies, £11,000 ; Eggs, £8,000 ; Milk and Cream, £15,000 ; Imported Spirits, £7,000 ; Tea, £18,000 ; Potatoes, £9,000 ; Imported wines, £12,000 (South African wines show a decrease of practically the same amount). Tobaccos of all sorts show an increased importation of £29,000.

Amongst decreases, the following are the principal items :—Ale, Beer and Stout, £7,000 ; Cheese, £4,000 ; under Corn, Grain and Flour there are some gratifying decreases : Barley, £3,000 ; Beans and Peas, £3,000 ; Kafir Corn, £7,000 ; Maize, £53,000 ; Oats, £17,000 ; under Meats, the decrease in Beef, Mutton, Pork and Poultry (including game) is well over £41,000, with a total reduction on meats of all kinds amounting to £47,000—a very encouraging item ; Pickles and Sauces fell off by £11,000 ; Agricultural Implements show a small decrease of £3,000 ; while in Agricultural Machinery the decrease is almost startling, £55,000, due probably to the rapid extension and competition in this class of business and consequent over-stocking ; Seeds show a big decrease, £28,000, which may, to a large extent, be accounted for by the exclusion in 1905-6 under this head of trees and plants which were included in the figure for 1904-5 ; Vehicles also show a big decrease, £59,000, a veritable finger-post of depression ; while the diminished import of Wood and Timber of all sorts, £69,000, recalls the falling off in building enterprise.

Exports.—Our exports of goods in any way relating to Agriculture for the year 1905-6 stand at £612,000 approximately, an increase of about £120,000 over the corresponding period.

Among the principal increases are items under Corn, Grain and Flour, nearly £5,000 ; Mohair, a very satisfactory increase of £12,000 ; Tobacco, £32,000 ; and Wool, £57,000—another substantial figure.

Among the decreases we find :—Animals, living, £134,000—due, no doubt, very largely to the extensive sales of Repatriation mules outside the Colony having ceased prior to the commencement of the last financial year.

* * * *

COMPARATIVE STATEMENT OF IMPORTS OF SOME PRINCIPAL ITEMS OF FARM PRODUCE INTO THE TRANSVAAL DURING THE FINANCIAL YEARS 1904-5 AND 1905-6.

Article	1904-5. £	1905-6. £
Butter, etc.	213,056	238,917
Barley	5,017	1,349
Beans and Peas	18,592	15,019
Bran	47,113	53,590
Cheese	51,539	47,204
Chicory	3,309	3,195
Eggs	116,283	124,464
Flour and Meal (Wheaten)	432,206	449,560
Fodder and Forage (Lucerne, Hay, Oat-hay, etc.)	175,551	145,229
Fruit, Fresh	144,045	153,345
Fruit, Dried (say)	25,000	25,000
Honey	1,105	1,014
Jams and Jellies	36,234	47,591
Kafir Corn	17,464	10,167
Maize	194,324	141,300
Maize Meal	24,335	23,329
Meats, Fresh and Game (including Poultry)	794,229	752,973
Meats, Preserved (including Hams and Bacon)	186,984	82,806
Milk and Cream	178,432	193,910
Oats	77,751	60,383
Tobacco, all sorts	220,610	249,604
Vegetables :—		
Onions	20,537	23,265
Potatoes	49,897	60,257
All other Fresh	20,090	28,405
Preserved	24,401	30,906
Wheat	11,152	10,967
Totals	£3,089,256	£2,973,749

If these figures mean anything they mean that at last the first milestone on the road of agricultural progress leading to the position we are striving to obtain—the Transvaal able to feed itself with its own produce—has been reached. The gratifying fact stands out that, the imports of farm produce into this Colony showed in 1905-6 a decided increase of £115,000 as compared with the previous year.

Encouraging as these figures must naturally be to everyone connected with agriculture in this Colony, it must not be forgotten that there is still much to be done before we reach the goal—food cheap and plentiful because it is grown at our own doors by our own people. We still import produce, which we should buy from our farmers if they had it to sell, amounting to nearly £3,000,000 a year, and included in that sum we find such items, to name but a few, as :—

Bacon and Hams	£98,000
Butter	238,000
Cheese	47,000
Eggs	124,000
Fodder and Forage	145,000
Fresh Fruit	153,000
Fresh Meat	752,000
Jams	47,000
Maize	141,000
Milk	193,000
Oats	60,000
Potatoes	60,000
Tobacco	249,000

Progressive farmers throughout the country are, we are glad to think, alive to the situation and in agreement as to the steps which should be taken to improve it. The extension of facilities for irrigation, the judicious supply of capital through the operations of Land Bank enterprise, the development of the co-operative principle in all branches of production and supply, are the weapons with which the agricultural industry must arm itself for the coming assault on the citadel of unnecessary imports, which is to-day in no small degree barring the progress and prosperity of the Transvaal.

* * * *

TRADE PREFERENCE WITHIN THE EMPIRE.

A Gazette Extraordinary, published on the 29th September, notifies that, under Article IV. of the South African Customs Union Convention, the rebates of Customs duties granted on goods and articles the growth, produce, or manufacture of the United Kingdom have, from the 1st October, 1906, been extended to goods and articles the growth, produce, or manufacture of the Commonwealth of Australia, the Government of the said Commonwealth having extended to goods and articles the growth, produce, or manufacture of the

South African Customs Union reciprocal privileges at the following rates :—

Article.	Rebate to be granted.
Tobacco, per lb.	9d.
Spirits	The difference between the Customs and the Excise duties, plus two-and-a-half per cent., equivalent to from eightpence to three shillings and ninepence per gallon.
Sugar	*a*. From cane grown by white labour, £2 per ton. *b*. From cane grown by black labour, £1 per ton.
Wine, in bottle	Per gallon, 5s.
Wine, in wood	Per gallon, 4s.
Maize	Per 100 lbs., 6d.
Fruit, green	Whole duty.
Fruit, dried	50 per cent. of duty.
Fish, dried	Per lb., ¼d.
Feathers	5 per cent. *ad valorem*.
Butter Cheese Confectionery Bran, Oats and Wheat Flour Hay and Fodder Jams Leather Agricultural and Mining Machinery Meats, including poultry Milk, Condensed or Concentrated Timber	Not less than 25 per cent. of any duty that may be leviable.

While welcoming an extension of the principle of reciprocal preference between States within the Empire, we may point out that the official Customs Returns show very clearly that the exports of South African Produce from the Transvaal to foreign countries are infinitesimal. Thus, of our exports (other than gold and diamonds) in August last, 96% went to various parts of the Empire and 4% to foreign countries, as against 91.9% and 8.1% respectively, for the corresponding month in 1905. Inclusive of gold and diamonds, the proportion of the exports of S. A. P. in August, 1906, from the Transvaal would be 99.9% to all parts of the British Empire, and 0.1% to foreign countries.

In the present state, therefore, of our external trade, the reciprocal tariff arrangement with Australia may be regarded, so far as the Transvaal is concerned, more as the pious affirmation of an important

principle than as a practical measure designed to retain within the Imperial circle trade which otherwise would be attracted to foreign ports. The rebates specified above will, undoubtedly, give a considerable impetus to Australia's export trade with South Africa, and that, without arguing as to which side got the best of the negotiation, is, we think, an occasion for congratulation on both sides.

* * * *

PEDIGREE STOCK.

The Department of Agriculture has recently imported for the herds and flocks at the Experimental Farm, Potchefstroom :—

Cattle.—Six 2 year-old "Lincoln Red" heifers (in calf) and two yearling heifers purchased from the famous milking herd of that breed, the property of Mr. John Evens, Burton, near Lincoln. Four 2 and 3 year-old Hereford heifers (in calf) and two yearling heifers purchased from the old established herd of Mr. G. H. Green, Wigmore Grange, Leintwardine, Herefordshire. Four 3 year-old Ayrshire heifers (in calf), purchased from the herds of Mr. Jas. R. W. Wallace, Auchenbrack, Thornhill, and Mr. Thomas Goldie, Oldhall, Kilmarnock, and one Ayrshire bull from the same deep milking herd of Mr. Wallace. A photograph of one of these Ayrshire heifers—Oldhall Lady Violet 2nd—appears in this number of the "Journal." (Plate CXLVIII.)

Sheep.—Two Suffolk rams from the flock of Mr. H. E. Smith, Walton, Suffolk, and two Shropshire rams from the flock of Sir R. P. Cooper, Bart., of Shenstone Court, Lichfield.

Pigs.—Four large black gelts from the herd of Mr. Kenneth M. Clark, Sudbourne, Suffolk. Four Berkshire sows from the herds of Her Grace the Duchess of Devonshire, Eastbourne, and Sir Alex. Henderson, Buscot, Faringdon. Four large white Yorkshire sows and one boar from the herds of the Earl of Ellesmere, Worsley Hall Stud Farm, near Manchester, and Sir Gilbert Greenall, Walton Hall, Warrington. One Tamworth boar from the herd of Mr. Robt. Ibbotson, Knowle, Warwickshire.

All these stock were delivered at Potchefstroom in good condition, with the exception of the two Berkshire boars and one large white Yorkshire sow, which, unfortunately, died on the voyage. It is worthy of note, however, that among 5 horses, 179 cattle, 112 sheep and 77 pigs imported during the last three years these are the first losses which have occurred.—A. H.

* * * *

THE GOVERNMENT TOBACCO FACTORY, TZANEEN.

It is expected that this enterprise will be in working order at an early date, and in a position to turn out supplies of tobacco, cigars, cigarettes and snuff of various descriptions.

In establishing this factory, the intention of the Government is not to enter into competition with private concerns of the same nature, but to use it, in conjunction with the experimental work being done on the estate, as an educational factor, by demonstrating the best methods of making Transvaal tobacco a marketable commodity in all parts of the world.

It has been long admitted that this country is particularly suitable for the cultivation of tobacco, and that with proper treatment and a knowledge of the influence of local conditions, that product can become one of our principal exports.

For many years tobacco has been grown throughout South Africa, but its special aroma is not always appreciated by smokers in other parts of the world. Transvaal tobacco is considered, however, to be one of the finest pipe tobaccos, but it should be recognised that, while possessing qualities peculiar to the country, considerable improvement must be made in the present methods of treatment before it will gain the popular taste in other markets. The Government are, therefore, making experiments in this direction and in the cultivation and distribution of new varieties of seed. There are such a large number of varieties of tobaccos, producing quite distinct qualities in the finished article, that one of the many points to be dealt with is the determination of the varieties best suited to different districts. The Tobacco Division of the Department of Agriculture has been formed with the object of improving the quality of the Transvaal tobacco leaf in general, and it is intended to do this by conducting experiments in manuring, cultivation, harvesting, curing, fermenting, classifying, etc., and breeding, in different districts, ideal types of tobacco. All these experiments, based on a knowledge of European and American methods, will, it is hoped, in a short time, yield valuable data, which will be placed at the disposal of farmers and manufacturers. If, for instance, the Sumatra leaf can be successfully grown in this country, and there is every indication that it can be, it will be possible to produce excellent cigars at very moderate rates, but at present the wrapper must be imported. When it is considered how much is annually spent on the importation of tobacco—unmanufactured and manufactured—it will be realised how much scope there is for enterprise in this product alone.

Hitherto there has been practically no market for tobacco in the Northern Transvaal, but since the establishment of the factory at Tzaneen, enabling the Government to purchase all the raw material offered, a great stimulus to production has been given.

At the Tzaneen Estate the different processes of cultivation, reaping, curing and manufacture can be studied, and students are taken through a course of training in all these subjects on payment of a small annual premium to cover cost of board and lodging.

The factory and farm at present employ 18 whites and 127 natives, and the supply of their wants has created a market for various products in a district where such a market has not hitherto existed to any extent. Local transport riders have also greatly benefited by the

Plate CXLI

No 1 — Cereals grown on the Experimental Farm Potchefstroom
No 2 — Trees and Plants exhibited by the Forestry Division
No 3 — Tobacco and Cotton from the Tzaneen Estate

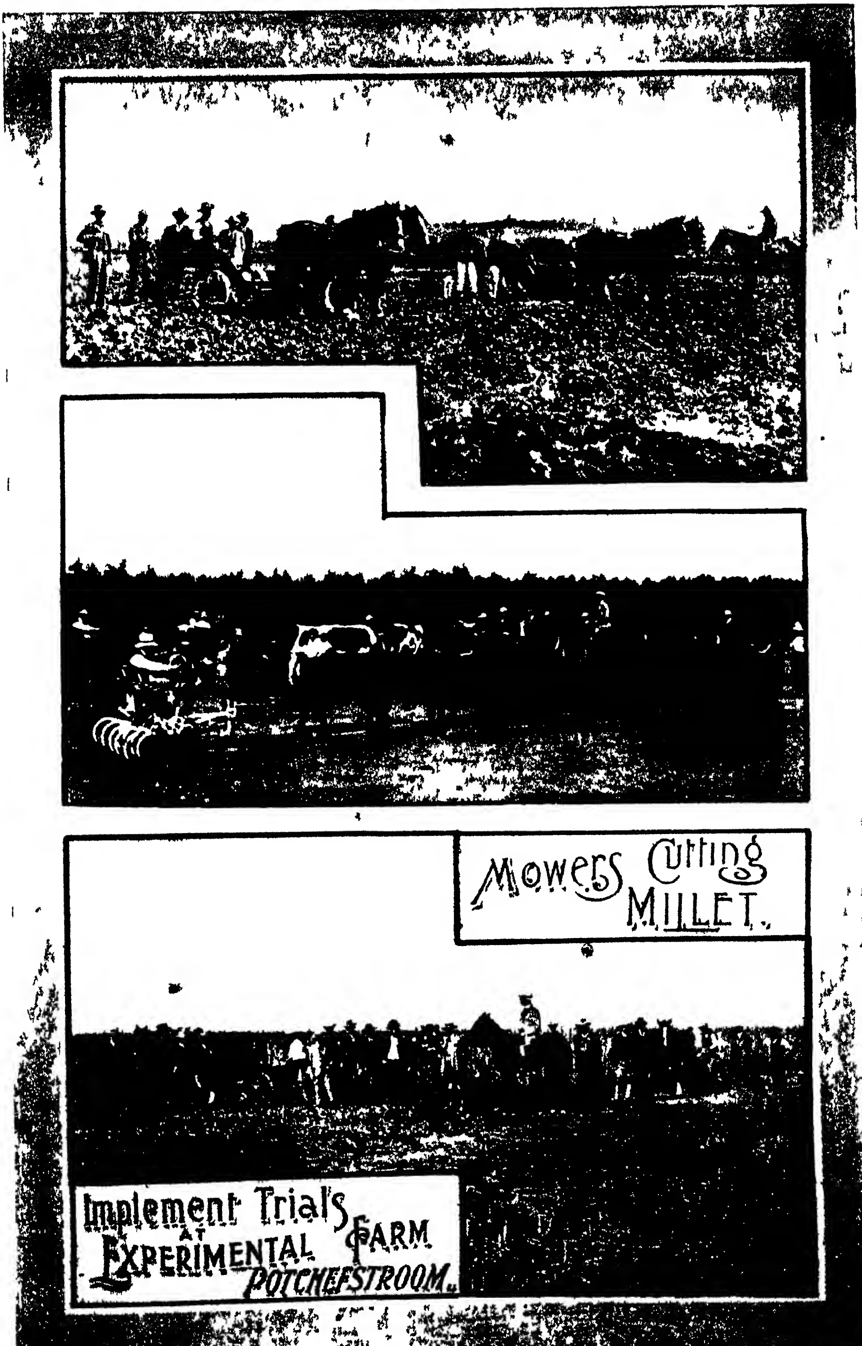
Mowers Cutting MILLET.
Implement Trials at Experimental Farm Potchefstroom.

Plate CXLVI

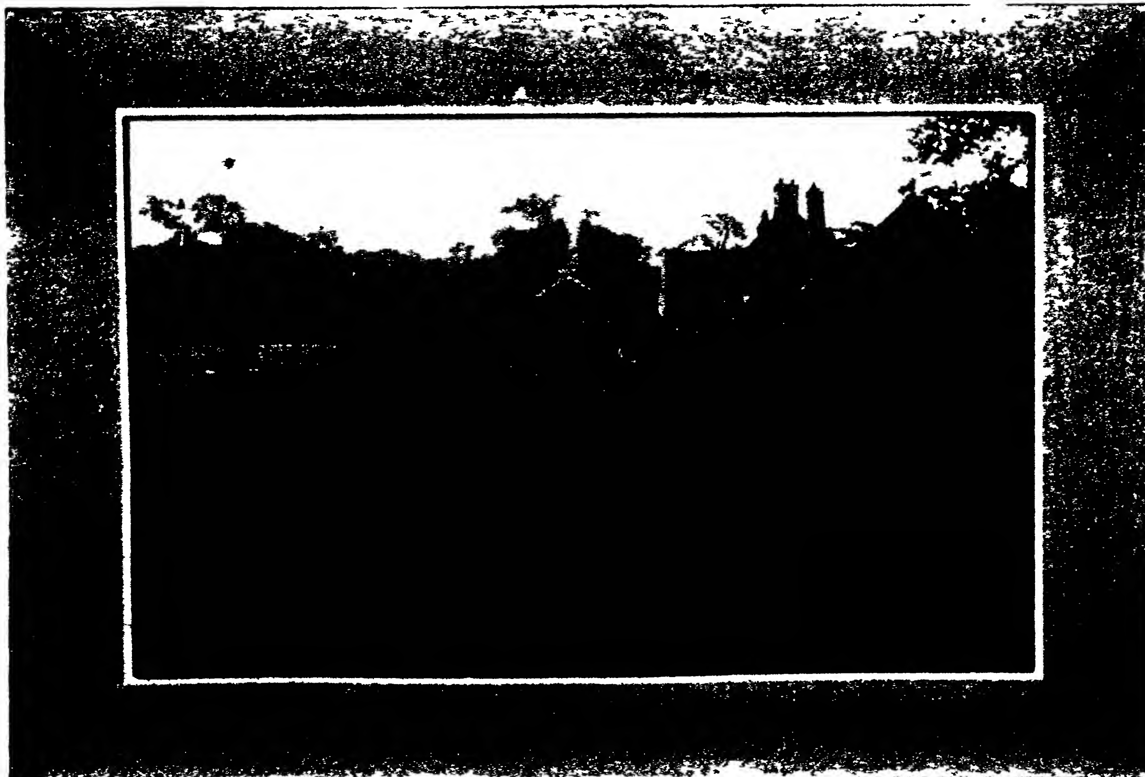

Plate CXIII

"Burton Rose"

Burton Rose (cow on left) from the celebrated herd of Lincoln Red Dairy Shorthorns of Mr JOHN EVENS, Burton near Lincoln—see vol vi p 146 Lincoln Red Herd Book—and granddam of Heifer No 74, imported by the Department of Agriculture

Plate CXLVIII

Ayrshire Cow.

OLDHALL LADY VIOLET II

Imported by the Department of Agriculture and now at the Experimental Farm, Potchefstroom

erection of the works, which, it is hoped, will in future years be extended to include jam making, cotton ginning, the extraction of fibre, etc.—H. E. King.

* * * *

SOUTH AFRICAN PRODUCTS EXHIBITION, LONDON, 1907.

As will be seen from the appended copy of a circular letter issued by the Director of Agriculture, it is proposed to hold an Exhibition of South African Products in London in the spring of next year.

The hall of the Royal Horticultural Society, at Vincent Square, Westminster, well known to those connected with the fruit trade, has been taken from February 13th to March 18th, 1907, and space allotted to the different Colonies as follows:—

	Square feet.
Cape Colony	4,500
Orange River Colony, Basutoland and Bechuanaland	1,428
Transvaal	2,500
Natal	2,000
Rhodesia	1,128

In addition to the exhibits it is intended that papers shall be read in the lecture rooms on the agricultural and industrial resources of each Colony.

Although it may be contended that the Transvaal is not for some years likely to become an exporter, yet it is desirable, even at this date, to fall into line with the other Colonies of South Africa, and show the particular advantages she has to offer to the settler or investor. We want not only our mineral resources developed, but also those of a more permanent character—some of which have been proved to exist, and others it is hoped to create. The possibilities of the Transvaal are many and varied, owing to the diffierent climates found within its borders. The cultivation of mealies, Kafir corn, oats, millet and other cereals on the high veld ; wheat, potatoes, onions, etc., on the middle veld; and oranges, pines, pawpaws, bananas, guavas, tobacco, rubber, fibres, cotton, etc., in the low country, together with stock-raising over a large portion of the country, afford a wide range of choice to the farmer, planter and investor. It is to draw attention to these potentialities of the land that this exhibition is to be held.

The tillage of the soil is still in its infancy, and local industries are confined to a comparatively few products, so that in no case can the markets of the Transvaal be fully supplied from internal sources. If by the aid of this exhibition, which will probably be the forerunner of others, capital and energy to develop our latent and varied resources can be attracted, the effort will not have been in vain.

The cost of the Exhibition is being borne entirely by the different South African Governments, and nothing is asked from trade exhibitors except that they appoint someone to look after their exhibits and give

the fullest information regarding them to visitors. An interesting feature is that the refreshments will be, as far as possible, of South African origin—wine, etc., from the Cape Colony, tea from Natal, and tobacco, cigarettes, etc., from the Transvaal and Rhodesia.

Transvaal exhibits must be despatched about the 10th of January next, and if the Government can arrange that they be carried free by the rail and steamship companies, the Department of Agriculture will undertake to receive and despatch them free of charge.—H. E. King.

[Circular Letter.]

Department of Agriculture,
1st September, 1906.

Sir,

I have the honour to inform you that it has been decided to hold an Exhibition of the products of the British South African Colonies in London early next year. The large Hall of the Horticultural Society, Westminster, has been secured for the purpose, and the various Governments have voted funds to defray the cost of the Exhibition.

It has been arranged that a small Executive Committee be formed in London to take charge of the interests of the Exhibiting Colonies on that side. The Agents-General for the Cape and Natal, and representatives of the Governments of the Transvaal, the Orange River Colony and Rhodesia will be members of the Committee, which will be responsible for the financial arrangements in connection with the Exhibition. Captain P. C. van B. Bam, M.L.A. (Cape Colony), has been appointed Chairman of this Committee.

A competent representative will attend the Exhibition, explain the Exhibits, and address Enquirers on the features and resources of the Transvaal.

Brightly written leaflets, with photographs illustrative of our principal products and resources will be provided.

In this connection I may add that the Exhibit of Citrus Fruits which was forwarded on behalf of some of our growers, by this Department, to the Colonial Fruit Show, held in London last June, was a pronounced success, and the award of medals very encouraging.

In asking your support and co-operation in this important undertaking, I need hardly say how desirable it is that the Exhibit of this Colony should be fully representative of our Agricultural and other resources, and in every respect worthy of the Transvaal.

The Exhibition will undoubtedly attract many visitors, and an unique opportunity will occur of interesting the British public, not only in the Agricultural progress which has already been made, but in the still greater progress which it is hoped will be realised in the near future.

The assistance of influential bodies throughout the Transvaal is essential, and will be a great help and encouragement to the Government: I therefore recommend the matter to your consideration,

and shall be glad to hear at your earliest convenience as to whether. and in what manner, you are prepared to further the objects of the Exhibition.

It is intended to call a meeting at an early date to form a local Committee, consisting of representatives of the Farming Industry, Chambers of Commerce, and Others.

The Government, acting through this Department, intends to do all in its power to make the Exhibition a success, and is preparing a collection of the natural products of the country. Space will, at the same time, be reserved for contributions by other Exhibitors.

Exhibits can be sent to form a part of the general one by the Government or as separate private Exhibits. It is hoped that the latter in particular will be a conspicuous feature, and it is believed that the arrangements for this class of Exhibit is a matter in which Chambers of Commerce will be prepared to take special interest.

Suggestions have been made for the formation of a permanent Transvaal collection at the Imperial Institute, and it may be possible to transfer to that Institution, at the close of the Exhibition, many of the contributions to the latter.

F. B. SMITH,
Director of Agriculture.

CORRESPONDENCE.

THE PYRAMIDS FARM.

To the Editor of the Agricultural Journal.

Sir,—The Pyramids Farm is situated about 12 miles north of Pretoria, and is bounded on the north by a range of hills which are the southern boundary of the Bushveld. Before the ravages of rinderpest and lung sickness, this district carried many cattle, which the war further depleted. The mixed veld and the shelter afforded by the kopjes and trees are eminently suited to stock raising.

Owing partly to the long-continued drought in the Karoo, Mr. R. H. Struben decided, in May, 1905, to send up about 150 head of Shorthorn cattle (Plate CXLIX.) from Tafelberg, C.C., and was advised by the Veterinary Department to inoculate them with redwater, as it was thought that the death rate would be lower by so doing, rather than by letting them get naturally infected through the tick. Dr. G. D. Maynard, who was residing on the farm, kindly supervised this inoculation, which proved to be very satisfactory in spite of the very poor condition of the cattle. Notes dealing with this inoculation were published in the last issue of the "Journal" (July, 1906). The last death from redwater occurred on November 4th, 1905, and since then none have shown any sign of redwater. They rapidly improved in condition after the first rains and have continued doing well. A few mixed cows were also imported from Bedford, C.C., during September, but these, coming from a redwater district, did not need to be treated.

The Shorthorn herd has been carefully bred at Tafelberg for some years, but the long continued droughts made it impossible to keep up their milk yield, owing to the intermittent calls made upon their udders. The yield of butter-fat of the herd is well above the average for the Transvaal, but the quantity needs improvement. It has, therefore, been decided to put Friesland bulls to the herd, thus improving the milk yield of the progeny and producing a useful animal for the dairy, yoke and butcher. This cross has proved very satisfactory in the Central States of America, where the climate and conditions are very similar to those of the Transvaal.

The scarcity of good fresh milk in Pretoria seemed to justify an attempt being made to supply this need, and a complete pasteurizing plant was erected, but it proved unsatisfactory, owing to the milk curdling about 30 hours after pasteurization. The Bacteriological Division kindly conducted a series of experiments with a view to determining the cause, and found it to be due to the presence of the hay bacillus (*Bacillus subtilis*), the spores of which are not killed at a temperature of 186° F., at which temperature the pasteurizing was done. Subsequent observation goes to show that the distribution of

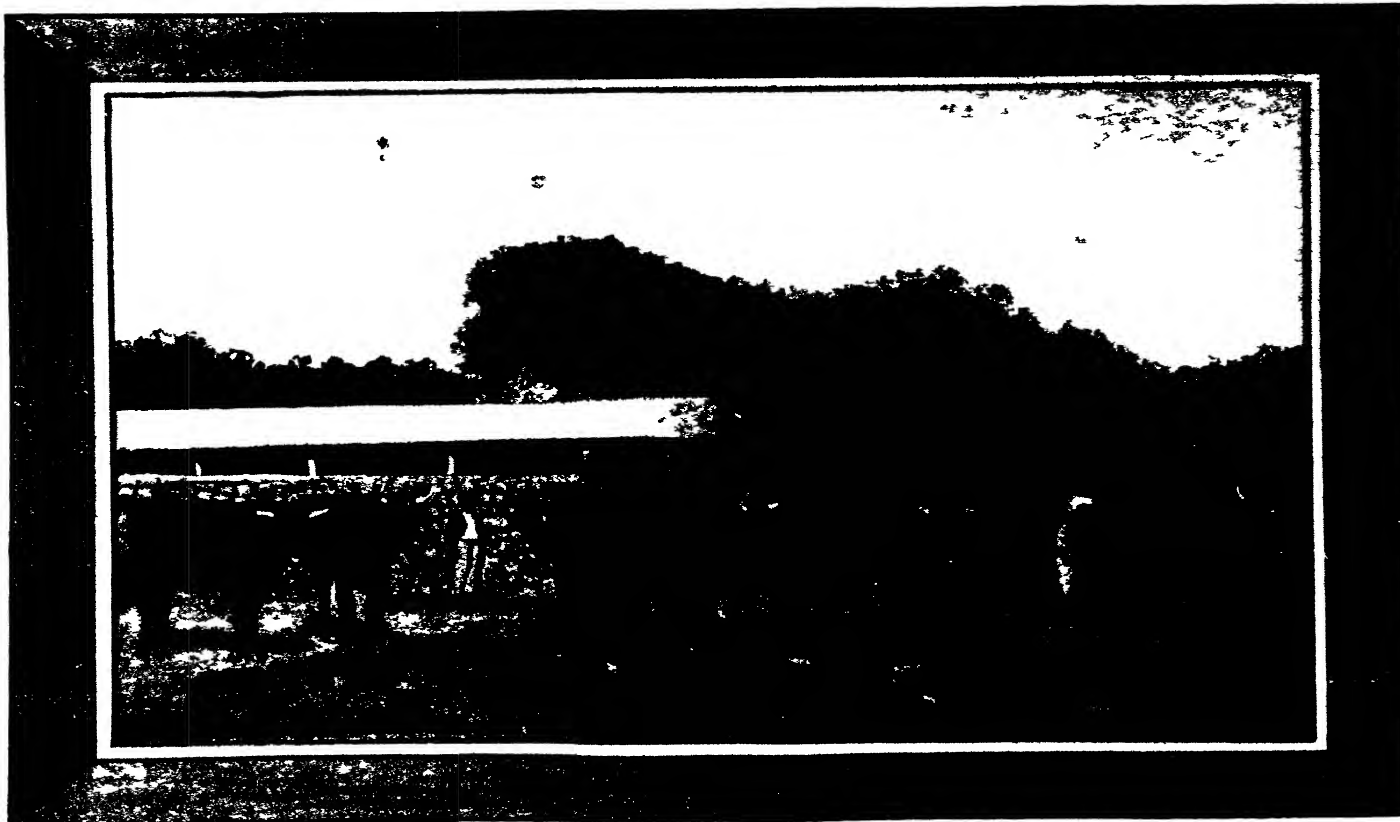

Plate CXLIX. Group of Shorthorns at Pyramids Farm.

B. subtilis is that of the middle and lower veld, and though inactive in the presence of lactic acid, it becomes troublesome as soon as it has a free field of action, as in pasteurized milk. In view of this fact, it was decided to discontinue the supply of milk and to utilise it in some other way. The most profitable use to which it could be put appeared to be in fattening pigs for market on skim milk, and either making butter or selling the cream. A few pure bred sows of three different breeds were therefore bought from the Government Farm at Potchefstroom. These sows are in pig to boars of their own breeds and will farrow at about the same time and be subjected to identical treatment in rearing. By this means a fair test of suitability will be made, and the breed which does best will be established on the farm. Extensive and up-to-date piggeries have been built, those for breeding pigs being some distance from those for the young fattening pigs. Our experience when gained as to the most suitable breed of pigs for this part of the district may be of interest to farmers.

In November, 1904, 300 cross-bred Persian Merino sheep were also imported from Cape Colony, and since then, at intervals, more have been brought up. They are dosed with one teaspoonful of Cooper's Dip and salt (in the proportion of one of the former to nine of the latter) upon arrival, and are put to Persian rams (Plate CL.). The increasing popularity of this breed, owing to its hardiness and early maturity, appears fully justified in this district.

Previous to the inoculation of our mules for horse-sickness by the Veterinary Division, they were stabled in a roomy mosquito proof building. Subsequently the mules were allowed to run at night, and early in January the sheep were stabled there at night, always being in before sunset and not allowed out before sunrise. This was done on account of blue tongue, which is very troublesome here during the first three months of the year. One night in February the sheep were not stabled, and two cases of blue tongue were noticed 9 and 10 days respectively after that night. Also a few cases occurred during the first two weeks of stabling. This, I think, only corroborates the general belief that blue tongue is due to the bite of some nocturnal flying insect, and presumably the few cases which occurred were animals which had contracted the sickness previous to stabling, or on the one occasion on which they were not stabled. These were first and second crosses from the Merino. Owing to its comparative immunity from heartwater and blue tongue, the Persian and its crosses are suitable in many districts where woolled sheep will not thrive, and often not even live. The accompanying photograph of Persian rams is one of some second and third class rams from Tafelberg which Mr. Struben sent up to test the demand of the district. It is his intention to establish a flock of pure bred Persian sheep on this farm in order to supply rams which are bred in the country and fully acclimatised, and, therefore, should be more suitable for use in it than those imported from Cape Colony.

After the third cross with Persian rams, the ewes may, in the writer's opinion, safely be allowed to raise two lambs in the year without detriment to the flock. The rams may be run with the ewes from

April 15th to the end of November. A Persian ewe will generally take the ram very shortly after lambing, therefore it will be seen that the majority will lamb in September and again in February. It has been found inadvisable to lamb down after April or before September, unless the ewes can be run on lucerne or some other green food for an hour or two daily, as the lambs may become stunted from lack of milk when small. Persian sheep may safely be run on lucerne without fear of loss by bloating, for though they may become hoven to some extent, they will not suffer seriously from the effects The foregoing remarks apply to a well-graded flock, and the quickest way to arrive at this is by choice of well-bred rams Till recently there has been some difficulty in obtaining well-bred Persian rams at a reasonable price. The consequence is that breeders have used cross-bred rams, and because these rams have proved satisfactory up to a certain point many have lost sight of the fact that better and more uniform results would have been produced from better rams. In no other breed of sheep does one see such indifferent animals used as rams, and when it is remembered that one ram will serve 40 to 50 ewes twice a year, the shortsightedness of this policy becomes apparent.

Yours, etc.,

P. McA. MAYNARD,
Manager.

The Pyramids Farm,
Pretoria.

* * * *

IMPORTING AUSTRALIAN SHEEP.

To the Editor of the Agricultural Journal.

Sir,—As I am shortly going to start sheep farming in the Standerton District, I shall be very much obliged if you will be so kind as to advise me on the following, viz:—

1. Which breed of ram I ought to purchase—the Rambouillet, Tasmanian or Australian, and your reason for selection?
2. Where I could purchase good young rams of the above breeds and at what price?
3. And whether ewes could be imported, in safety, from Barkly East into Standerton District during August month so that they could lamb there in September; if not, which month do you recommend to import from the Cape Colony?

I shall also be glad if you will send me the following back numbers of the "Journal" if you have them in stock, viz., 1, 2, 3, 7, 8 and 9.

Thanking you in anticipation,

Yours, etc.,

B. ENSLIN.

P. O. Box 5323,
Johannesburg.

Answer:

1. No one can say with truth that any one type of sheep is the best, and the choice of a type is very much a matter of personal taste

and inclination. At the same time, it cannot be denied that some types need for their most satisfactory development some special conditions, resulting from soil or climate; therefore some sheep are most valuable for special localities. This, however, can only be conclusively proved by the result of years of uninterrupted experience, which no one possesses of the Transvaal, so it follows that an answer to this question can only be an opinion based on general rather than local experience.

I would recommend the Tasmanian or New South Wales fine-woolled Merino; if the latter, to be purchased from either the New England, Upper Hunter, or Orange and Molong Districts. My reasons relate chiefly to the climatic conditions, which have a great influence on the different types of wool and breeds of sheep.

2. The term "good" is too broad; it should be either "good flocks" or "good studs." I would advise Mr. Enslin to write to Messrs. Goldsbrough, Mort & Co., of Sydney, who are not only reliable people in every way, but are agents to all the leading Tasmanian breeders, and, of course, in touch with those of New South Wales. He should set forth exactly what he wants, *i.e.*, studs or flocks, and say what price he is prepared to pay. If purchasing in any numbers, he would get flocks from £5 to £7 per head; studs, of course, have practically no limit to their range of prices. These agents would, I am sure, select and forward for Mr. Enslin.

3. Certainly not. It is most dangerous to handle ewes in such an advanced stage of pregnancy, therefore a train journey from Barkly East to Standerton, under these circumstances, is out of the question. In choosing the most suitable time for bringing sheep from Cape Colony to Standerton one must be guided by circumstances. Speaking generally of dry sheep in good condition, any time would do, always provided that if it be winter sufficient feed is assured to carry them on till the spring.

Land Department, RICHARD DOYLE.
Pretoria.

* * * *

POULTRY AS HUMAN FOOD.

To the Editor of the Agricultural Journal.

Sir,—Recent events have drawn the attention of the public to the question of the wholesomeness of foods, and more particularly meat foods, consumed by the population. On all sides we hear denunciation of the wickedness, or astonishment at the carelessness of the American meat packer, but the carelessness and indifference of the consumer, who purchases for his own food and not to sell to anyone foolish enough to buy, is still more amazing. In no class of food is this more noticeable than in that of poultry. The ordinary housewife cannot be expected to be an expert judge of a piece of frozen or tinned meat, but anyone with a little knowledge can tell a good wholesome fowl from a bad one, and it is the purpose of this article to give a few details as to the choosing of fowls for table purposes.

In this country fowls are usually purchased alive, and there is, therefore, no excuse for making mistakes, although, judging from the creatures sold on the markets or hawked around by coolies, anything with feathers on is considered a fowl, or rather a "chicken," by the purchaser, the only consideration being "cheapness," that is, lowness of total cost irrespective of quality or quantity of meat.

In judging a fowl for table purposes the first thing to look to is that the bird is in a healthy condition, and the first point to notice is the comb. If it is blue or purple the bird is probably suffering from liver disease; if it is white or pale pink, it probably has consumption, and although it is by no means certain that consumption in fowls is communicable to human beings, the flesh is certainly unhealthy and innutritious. Small undersized birds are also probably consumptive.

A good young cockerel, which has been properly fattened for the table, should weigh 8 or 9 lbs. live weight, and it would be very unwise to buy one for food weighing less than 5lbs. live weight. A small fowl is not necessarily unhealthy, but unless the purchaser knows that it is not, he should leave it alone. Of course, only young cockerels should be bought; hens, if exposed for sale, are either diseased or very old and useless as layers, and very tough.

People with a little spare ground would find it pay them well to buy a dozen at a time and keep them on soft diet for use as desired. Birds fattening for the table require very little space. They should be fed on mealie meal, mixed with skim or sour milk and a little fat, two or three times a day. Never leave food lying about in the pen. They should not be kept fattening longer than about six weeks, as after that they lose flesh.

The best type of table fowl is a heavy solid fowl with large full square-shaped breast and short legs—such breeds as Orpingtons, game, houdans, dorkings, and birds of similar shape.

Finally, a word as to killing. The usual way is to wring or dislocate the neck, but with large cockerels this requires some knack. A very good and simple way is to strike off the head with a hatchet. This causes the blood to leave the carcase which, some consider spoils the flavour, but in this hot climate it probably adds to the keeping quality of the meat. Do not hold the bird by the head and swing the body round as Kafir servants so often do; this is not only cruel, but it causes a feverish and inflamed condition before death, and so accelerates decomposition.

This is a country particularly suited to the breeding of table poultry, and attention to the points above mentioned would not only ensure good food in the present, but would, especially purchase by weight, encourage good breeding and good feeding, and so help to increase the supply of the most delicious of all animal foods, and reduce the present cost of living.

Yours, etc.,

Num Num, A. de A. DONISTHORPE.
Nylstroom.

DAMAGE TO ORANGE GROVE.

To the Editor of the Agricultural Journal.

Sir,—Some five weeks ago we had a very high wind here, and much damage was done to my young orange grove by the wind stripping the loose soil off the ground, leaving the roots of the young trees exposed, and in some cases stripping the soil off to a depth of several inches, in fact, as deep as the plough and cultivator had worked.

To prevent the roots of the trees being again exposed if another bad wind occurred, I gave the trees a good watering, and instead of forking round them afterwards, as is my practice, I left them as they were, thinking the ground would dry hard and not be easily moved. I was, however, wrong in my estimate, as we have just had another bad wind exposing the roots of the trees worse than ever. The exposure to the roots is not the only damage, as much hurt is caused to the trees by the flying particles of soil and sand. The damage is much worse to the land and trees where the soil has been kept clean; in some parts, where I have not been able to get rid of the quick grass and sweet potatoes, the damage is not nearly so great, and is, in fact, of minor importance.

My object in writing to you is to find out the best thing to prevent this occurring in future years; a guard round the trees will prevent the exposure to the roots, but is no protection to the remainder of the ground generally. Shelter trees as wind breaks take a long time to grow, and unless planted in the form of hedges, and at more or less frequent intervals, would be of small protection.

By drawing a lesson from the parts of the ground encumbered by the quick grass and sweet potatoes, which latter are still pretty green here, I think that if it were possible to sow a crop in the late summer and allow it to remain on the land all through the winter and windy weather, an adequate protection for the ground would be found. This crop could be ploughed in with the early rains and form a manure. Would you be so kind as to favour me with your views and advice on this point, and state what would be best to sow?

Again, as regards shelter trees for wind breaks, these round the lands are most desirable, and gum is, I suppose, the best, but to divide one's orange grove of, say, 1,000 trees up by lines of blue gums seems to me a horrible idea, but if nothing else can be found it is, of course, better than sacrificing the grove. Do you consider that lines of peach trees set, say, 12 ft. apart, would prove effective? I do not know if leafless trees would be of much shelter? But peaches are not unsightly; they do not take as much out of the ground as gums, and they are, of course, profitable.

Thinking this question may be of interest to fruit growers generally, and thanking you in anticipation for your reply,

Yours, etc.,

J. C. P. MAYNARD.

Athelstead Fruit Farm,
Wolhuter's Kop,
Pretoria.

Answer:

It is my custom, in giving advice as to the selection of a site for a citrus orchard, to be precise, and to insist upon a sheltered situation, whether obtained from some natural formation of the hill-slopes or by means of a wind-break of trees. However, there are, unfortunately, many old orchards which have been planted without reference to this consideration, with the result that with the recurrence of our windy months, a certain amount of loss (in some cases large) occurs from the dropping of fruit every year.

The remedy for this is to plant at once the quickest growing trees you can procure, as a shelter belt. Some kind of gums put on a wonderfully rapid growth, and in the course of a few years their presence would do much to alleviate the conditions under which you are labouring at present. The one drawback to the eucalyptus is that it is a greedy surface feeder, and on that account should not be planted very near to the fruit trees. At a distance of forty feet from the outside row, little damage may be feared if the precaution of digging a trench at about halfway between the wind-break and the orchard is taken to prevent the spread of roots.

The gum is advantageous, also, in so far as it is a naturally high tree, and the higher the wind-break is the more protection it will afford; the beneficial effects are naturally felt over a great area. What this area may be in exact proportion to the height of the tree I am not able to state at present, but from my knowledge of your farm, I am of opinion that one row of gums planted in the right spot would be quite sufficient as a safeguard. In ordinary practice, wind-breaks and trees are, or should be, planted at the same time; where, however, this has not been done every effort should be made to repair the neglect at the earliest opportunity.

I cannot support the idea of planting peach trees as wind-breaks. At the very time you want the leaves most, these trees are bare. I should not, were I in your place, entertain the project for a moment.

I note your remarks about the blowing of sand, and can quite sympathise with you, having suffered much in my early experience in Cape Colony with winds which they term down there "South-easters." My own impression on making acquaintance with this wind was that it was a hurricane. Even this was rendered harmless by the simple method of planting a row of rye between every row of trees. When fully grown, the ears were cut off and the straw allowed to remain at a height of about 12 to 18 inches, depending on the growth; the result was that no further blowing of sand occurred. This system could be adopted by you with every prospect of success. There is no reason for allowing the rye to ear out beyond the strengthening of the straw, but even if unripe the use of this method will be found successful. General cropping of winter oats, sweet potatoes, or other crop would answer the same purpose, but the drain upon the soil would be unwise.

R. A. DAVIS,

Pretoria. *Government Horticulturist.*

FRUIT CULTURE.

To the Editor of the Agricultural Journal.

Sir,—It is unnecessary for me to state here how important the "Agricultural Journal" is for the population of the Transvaal. The useful hints which appear monthly not only resulted in (1) a more efficient treatment of the different crops, but they also (2) increased the possibility of making a living on a farm. While so much is done for agriculture and stock raising by the Transvaal Government—more, perhaps, than in any other country in the world—could not more attention be paid to fruit culture on a big scale? This branch of the agricultural industry would certainly give splendid results. True, from time to time an article on fruit culture appears in the "Agricultural Journal," and our newspapers also devote one or two columns to the subject, but direct hints are never given which would introduce a better organisation.

I know, however, some farmers in the vicinity of Johannesburg, who, induced by these few articles in the newspapers, purchased hundreds of fruit trees. Let us now consider the question whether they had any success with their new enterprise. My answer is decidedly, no; and the reasons are not far to seek. The want of experience with regard to fruit culture is the direct cause of this failure.

In laying out an orchard the principal points to be observed are undoubtedly:—

1. The suitability of the soil.
2. The choice of varieties.
3. The manner of planting.
4. The manner of grafting.

In order not to take up too much of your valuable space, I only wish to say a few words concerning the manner of grafting, as my advice might possibly be of value to some of your readers. I know by experience that but few persons (in the Transvaal) are acquainted with the grafting of fruit trees. Where the results obtained by grafting are unknown, I would rather advise intending fruit growers not to hinder the trees in their natural growth.

I trust this letter will induce others to give their opinion on this much important branch of horticulture.

Thanking you for the space afforded me, I remain,

Yours, etc.,

East Rand. A. VLASKAMP.

Answer:

I am pleased to gather from your remarks that on the whole you appreciate the efforts made by the members of the Agricultural Department towards the forwarding of the farmers' interests generally but regret to find that you do not consider the fruit interests of the country are looked after as they might be. Perhaps a few remarks on this subject will serve to show you just what is being done.

I would first deal with your statement anent the occasional appearance of an article on fruit growing in the "Journal," and state that the reason no fruit section has been printed is simply owing to the fact that I have had no time to write a single article for the last six months. Perhaps my statement that a large number of letters, amounting to hundreds, has been dealt with by me on Sundays and at night in my home may seem to you overdrawn, yet it is a simple fact. The whole of my time is devoted to forwarding the fruit growing interests of this Colony, and if you have not found me acting as a missionary in those interests at East Rand, it is only because of my inability to be present in more than one place at one time. About one-third of the year is spent in travelling and preaching fruit growing and its advantages, the remainder in the office. I would ask you whether you have ever been to the Potchefstroom Experimental Orchard? and if not, suggest that a visit to that plantation might be of interest. There are also orchards of an experimental nature at Ermelo, Warm Baths and Zeerust, and at all of these stations visitors are warmly welcomed. Further, cuttings of any kind of fruit trees grown are to be had for the asking, and in the season a few choice fruit trees may be obtained. This latter item will, however, shortly be discontinued. In addition to my work, the managers of these different orchards form each a centre for the dissemination of information, and give instruction in such matters as budding and grafting trees, vines, etc.

It appears to me to be unfortunate that you have not, apparently, read "Journals" of date previous to April of this year, as from that date only has this Division been unrepresented in print.

I quite agree with you in three of the points that you raise. No. 4, the "manner of grafting," does not quite meet the case, as practically all fruit trees are now propagated by means of budding instead of grafting, and I may say at once that such trees only should be planted and none other. It is impossible to place any reliance on trees grown from seed; sometimes, only very occasionally, they come "true to name." Perhaps once in a thousand, or less. True, some sorts, termed "natural varieties," such as some Transvaal peaches, may be relied upon, but at the best they are second rate, and will never make a name for the Transvaal as a fruit producing country. Budded trees fill the needs of all planters; you can, by selecting the right kinds, procure early, medium and late fruiting varieties of all the different species. Their behaviour is known, and their bearing qualities can be relied upon, whilst the quality of the fruit is of the best.

Should you be in need of any special information on any subject connected with fruit growing at any time, I should be pleased to hear from you, and any question you might submit would receive my careful attention.

R. A. DAVIS,

Pretoria. *Government Horticulturist.*

POULTRY AILMENTS.

To the Editor of the Agricultural Journal.

Sir,—Many thanks for the "Agricultural Journal." It appears to me that there is a good deal to be learnt from it, especially the remedy for Cut Worms, since this plague has robbed us of all vegetables last year.

It will be a great pleasure to me to receive a leaflet, and also some advice for diseases in poultry. The general complaint is that there is a well-known fowl disease (pip) prevalent this year. A hard crust forms over the tongue (with a pointed tip); the result is that they cannot eat; when pecking the food it falls back again. This disease also causes sore eyes and a swollen head.

Speekfontein, Yours, etc.,

P. O. Witbank. H. F. du TOIT, Senr.

Answer:

Pip can scarcely be called a disease, but at the same time it is the cause of many deaths amongst poultry. It is due to the nostrils being stopped, and the bird being thus compelled to breathe through its mouth. In bad cases, in order to afford immediate relief, you may cut off about one-eighth of an inch of the hard substance at the end of the tongue, but not more, or you will make the tongue bleed, which will cause more pain than the pip itself; then rub a little glycerine on the tongue, and in the course of two or three days the hard substance will easily come off, but you must also pay attention to the nostrils and keep them clean in order to remove the cause of the pip.

The cause of the sore eyes and swollen head is not due to the pip, but is the result of the cold; thus both complaints to which you refer are due to the birds having colds. Colds in poultry are generally due to one of the following causes: Exposed positions, damp runs, or draughts, ill ventilated houses; the latter is probably the cause in your case. By all means let the houses be well ventilated, but see that the fowls are roosting out of a draught.

Keep the birds warm; feed on nourishing soft food, to which should be added the following spice:—

Fenugreek
Aniseed
Ginger
Liquorice (powdered) } Equal parts.

1 tablespoonful to 25 birds, mixed in soft food.

Bathe the eyes and nostrils well every day with warm water with some disinfectant added, but take care that the birds are kept in a warm place, or all your trouble will be thrown away.

R. BOURLAY,
Poultry Expert.

Experimental Farm,
Potchefstroom.

IMPORTATION OF BIRDS TO DESTROY BUGS.

To the Editor of the Agricultural Journal.

Sir,—Several times in your "Journal" we have noticed letters referring to the damage caused by the small bug in vegetable gardens, especially to turnips and cabbages. We think you have given its name as the Braganza Fly, but are not quite sure. We would like to suggest the following plan, for if not successful in exterminating the pests, we are sure it would help a great deal to keep it in check. That is to import starlings from England or Australia, as they are birds that live entirely on insects, etc., and, as far as we know, have never been guilty of eating fruit or grain crops. We are both Australians and have each had experience of the benefit they have been to friends of ours in farming. In one case a crop of wheat was in danger of being utterly ruined by an invasion of very small green caterpillars, but on a quantity of starlings being brought there and let loose in the field, all danger was soon over. If the Department would care to make the experiment, we would look after some of the birds and report all news of their proceedings. We have had experience with the birds and would know how to handle them. We are fruit growers and vegetable gardeners, and are not at all frightened of their doing any damage to the fruit. And, with the exception of a few, most of the trees are far above the average. Hoping to hear what you think of our suggestion, or if any other remedy has been discovered.

Yours, etc.,

Krugersdorp. PETERSON & TECHOW.

Answer:

I do not think it would be good policy to import these birds. In proof, I would call your attention to the case of the importation of the English starling into New Zealand for the destruction of insects. These birds multiplied rapidly, and soon became a worse pest than the insects they should have destroyed. Another instance is the English sparrow in the United States of America. They were introduced there to destroy insects but proved quite a failure. On the contrary, they have increased to an enormous extent and driven out and destroyed many native birds which were destroying the insects. Both the English sparrow and the English starling have been introduced into South Africa, the former at Capetown and the latter at Durban, and undoubtedly, in a few years, will be as far north as this, which is to be regretted.

The Bagrada Bug can be kept in check by much safer methods. Among these are clean culture, destroying of all cruciferous weeds, and the destruction of all remnants of cabbage or other members of this group of plants, after the crop has been gathered.

Before the crop has been planted, the bug in the field can be destroyed by setting out a small plot of mustard. This should be protected by a cloth until well grown. The bugs are extremely fond

of mustard, and prefer it to cabbage, turnip. etc.; as soon as it is uncovered they will go to it at once; the mustard can then be destroyed by spraying it with paraffin.

In the next "Agricultural Journal" there will appear an article dealing more fully with this subject. If you do not receive the "Journal," I will be glad to forward your name to the Editor, and have it placed on the list to receive it.

C. W. HOWARD,
Assistant Entomolgist.

Pretoria.

* * * *

DESTRUCTIVE BIRDS.

To the Editor of the Agricultural Journal.

Sir,—The South African Ornithologists' Union has received recently a variety of complaints from farmers in different parts of South Africa, relative to the destruction of various kinds of crops by the depredations of different species of birds. During the last harvest, in some parts of the Orange River Colony, wheat, oats and Kafir corn were seriously devastated by large flocks of small birds, which, as far as can be ascertained, consisted of *Pyromelana oryx* (Red Bishop bird), sometimes known as the Red Kafir Fink, and *Coliopasser procne* (Great-tailed Widow bird), familiarly known as the Kafir Fink or "Sakabula." On the Modder River another small species, *Quelea quelea* (the Red-billed Weaver), has increased to a most alarming extent, and a number of farmers in the Korannaberg district have given up the sowing of grain owing to the destruction wrought on the crops by the destructiveness of these and other small similar birds.

The Union has been asked whether it can suggest any remedy for this somewhat serious state of affairs, which was discussed at the third annual meeting of the Union, held recently. No one, however, seemed able to put forward any practical suggestion, except the use of poisoned grain, which has been found of service in other countries, but the use of which is open to many obvious objections.

I should be greatly obliged if, through the medium of your "Journal," you would give publicity to these complaints, as it may be that some of your readers can recommend some feasible remedy which could be adopted by those who suffer.

Yours, etc.,

JOHN A. BUCKNILL, M.A., F.Z.S., M.B.O.V.,
President of the South African Ornithologists' Union.

Note:

We have had great trouble with small birds at the Skinner's Court Experiment Station and the Experiment Farm at Potchefstroom,

where it has been most difficult to secure seed from the experimental plots of wheat, pearl-millet, manna, and similar small grains.

Kafir cranes are said to cause much loss of young mealie plants in the Standerton District, pulling them out along the rows as rooks do with wheat in England.—[J. BURTT-DAVY, Agrostologist and Botanist.]

* * * *

KHAKI GRASS.

To the Editor of the Agricultural Journal.

Sir,—We have read how the Argentine Republic has suffered in the loss of vast tracts of valuable grazing ground through the spread of the European thistle, the seeds of which came into the country with cheap imported wheat and got sown on the farmers' lands; and how the grazing lands of Australia, to a great extent, less than fifty years ago, were sown with ruin by the importation of the "Bathurst weed," hidden in the long hair of a number of Indian ponies imported from Patagonia; and what the sweet-briar and gorse did soon after their appearance in spreading over enormous tracts of land in Tasmania, and how the water-cress, planted years ago by a well-meaning farmer, and allowed to go unchecked, choked up one of the finest rivers in that country. We know, too, what the importation of "burr" and other noxious weeds have done, and are threatening to do, for South Africa, unless the inhabitants make determined efforts to eradicate them, and yet there appears to be no notice taken of a weed that is fast spreading all over the country, from the western borders of the Transvaal and known to you as *Alternanthera echinata*, imported from South America, and known to the Boers as "Khaki grass," owing to its khaki colour when dry, and the idea that it came into the Transvaal during the late war. The sharp spines of this weed prick the lips and tongues of animals when out grazing, fasten on the tyres of bicycles, and stick into the feet of bare-footed people, dogs, cats, etc. In winter, when the seeds are ripe and weeds are dead, it breaks into small particles and is carried away by the spring winds all over the veld, to spread over new ground when moistened by the first rains. If measures be not taken soon to check the spreading of this noxious weed and eradicate it, there will be great difficulty and much expense to do so in future, and it is making this country unbearable to the stock farmer.

Yours, etc.,

Zeerust. P. J. FROST.

Note:

The Botanist has replied to the effect that he is preparing a draft noxious weed law, and that it is proposed to include the khaki weed (*Alternanthera echinata*) in the schedule of noxious weeds.—[Acting Ed., T.A.J.]

APPLICATION FOR COTTON AND TOBACCO SEEDS.

To the Editor of the Agricultural Journal.

Sir,—I am writing to you to know if you could supply me with a small quantity of cotton and tobacco seeds. I have been informed that the Government are very willing to help beginners, and if this is so I should to take advantage of it. I am quite a beginner in this country, but have been lucky in getting the old property that Mr. T. Shepstone had when in this country. I think both tobacco and cotton will do well here, and I am not quite dependent on the rainfall alone.

Yours, etc.,
CHARLES B. HANDS.

Shepstone's Farm,
Mbabane,
Swaziland.

Answer :

I shall be glad to send you cotton seed for 5 acres if you will kindly fill out and return the enclosed leaflet, No 3. The condition on which we distribute cotton seed is that the whole of the crop grown from this seed shall be sent to the British Cotton Growing Association for sale, the seed having been supplied by that Association for this purpose.

I enclose leaflet on the cultivation of cotton.

J. BURTT-DAVY,
Agrostologist and Botanist.

Pretoria.

Answer :

I have the honour to forward herewith four samples of tobacco seed as under, purely for trial purposes, but which I cannot recommend for your locality.

Part of the work of this Division will be to determine the varieties of tobacco seed best suited to the different parts of the country. This work will necessitate experiments extending over one or two seasons, after which time we hope to be in a position to supply some valuable information to farmers throughout the country in regard to the best varieties to plant. In the meantime, however, I regret that, owing to the fact that up to the present no such experiments have been conducted, we are unable to recommend any particular variety of seed.

Perhaps you will be good enough to let me know what success you have with the enclosed examples.

J. van LEENHOFF,
Tobacco Expert.

Pretoria.

1 Sample Gooch.
1 Sample Hester.
1 Sample Yellow Orinoco.
1 Sample Virginia Bright.

OSTRICH FARMING IN SOUTH-WESTERN TRANSVAAL.

To the Editor of the Agricultural Journal.

Sir,—Of late a good deal of querying and discussions have ensued as to whether ostrich farming could be carried on successfully here; as first proof—Was this not at one time the home of the wild ostrich? Would they have stayed here of their own free will, had it not been suitable for them, until either shot or frightened away by the advance of the white man?

I have had many years of experience in farming with ostriches, and am now convinced, with the following proof, that they will do here.

I have had birds here for the last three months; some of them are between two and three years and very well bred, and were brought up on lucerne until they came here from the Western Province, Cape Colony. Birds from two to three years old are at a very delicate age, changing their chick feathers, or, to use a common phrase, "Wesseling."

The said birds are running in a camp which has a good bit of vaalbush and a little mimosa. They are very fond of the seed of the mimosa, and have taken readily to the vaalbush flowers, which is a capital thing as the vaalbush flowers during the winter.

Each bird gets one pound of mealies per day, and they are in prime condition. During the summer, say eight months, they will live on weeds and seed grass, and I am sure a very good, clean feather will be grown here, owing to the light sandy nature of the soil.

Yours, etc.,

Elsendale, A. S. PRINGLE.
Christiana.

* * * *

GOVERNMENT GRANTS AND STOCK BREEDING.

To the Editor of the Agricultural Journal.

Sir,—In a short but interesting article on horse breeding by Col. Hotham which appeared in the "Journal" last January, allusion is made to this subject, and, as the matter is one of interest to farmers generally, perhaps a few remarks as to what has been done elsewhere may be acceptable.

Col. Hotham mentioned briefly that large horse breeding schemes have already been instituted by the leading Continental nations of Europe, but, unfortunately, he does not enter into details as to the working of these. As far as my recollection goes with regard to particulars of such schemes as have come to my personal knowledge, the success attendant on the present working of these State-aided schemes has, in many cases, been the result of prolonged experience, which often proved very costly at the outset. To give one instance, the horse and cattle breeding schemes under the Department of Agriculture in Ireland have recently proved most successful. This Department is of comparatively recent origin, but long before its existence much had been attempted in this respect with more or less success.

Col. Hotham apparently suggests for this country, as a commencement, the supply of pure-bred sires by the Government, but he does not give us any suggestions as to how this is to be economically carried out. Before the existence of the Department of Agriculture in Ireland a scheme of this sort was undertaken by the Congested Districts Board. This institution had the administration of a large public grant to better the condition of certain large communities of small farmers and crofters occupying remote districts in the west of Ireland. The districts consist chiefly of poor mountainous country along the coast of the Atlantic. The work which was, apparently, carefully and thoroughly undertaken, included the supply of the best stallions and bulls for the use of the people, but some of the results were by no means satisfactory, and, generally, the outlay was out of all proportion to the economic value of the scheme.

The stock breeding schemes promoted in recent years by the Irish Department of Agriculture are, on the other hand, well worthy of consideration. The system had been chiefly evolved, previously, by the Royal Dublin Society, and, apparently, originated with their local stock shows. The present result of that system is that their annual fixtures at Ball's Bridge, Dublin, have become of almost universal interest to breeders of high-class stock. Under this system, premiums are given to stallions, bulls and boars owned by private individual farmers, and it has been so extended and elaborated, under the new Department of Agriculture, that every district in the country is thoroughly provided for. But, as Col. Hotham remarks; "Farmers too often breed from old, unsound, worn out mares"; so it was found in Ireland that poor farmers, and some in better circumstances as well, were too often tempted to part with their best fillies and heifers which found ready sale with dealers, whilst the inferior or blemished ones, not worth bringing to market, were frequently considered good enough to breed from. It soon became evident to the administrators of the stock breeding schemes—once these had attained a practical working basis—that such inferior mares and cows could not be expected to produce valuable offspring, no matter how good the sires they were mated with; so that, latterly, even more attention has been paid to the retention of good cows and mares by the farmers, and already a great improvement has been effected. This has been attained in various ways; chiefly through special classes at local shows for cows and heifers, as well as for young mares used for breeding. The prizes offered are not actually so high, but often extend to a fifth or even sixth cash award in one class. Should there be no local shows convenient, special shows are arranged by the Department at some convenient railway station or in a village street, where a small but expert staff are sent to officiate. As there is no entry charge, and any small farmer can compete, much interest is often exhibited locally in the proceedings. Meetings of this sort are held annually in all horse breeding centres to select mares for nominations for free service, and, as a rule, there is keen competition for such nominations, all selected animals being duly passed by a veterinary surgeon.

Not only have these schemes given most successful results, but their working is at present organised upon an extensive scale at comparatively moderate expense. The funds are derived partly from the local rates and partly from a public grant. The Board of Agriculture usually guarantee an equal amount to that raised under any local body. A general scheme is arranged and published each year in advance under a central committee organised by the Department, and a local committee is appointed by each County Council. All local arrangements are carried out by the local committees subject to the approval of the central committee, and the officials employed by each co-operate when required. As many of these officials are only temporary, being appointed specially for judging stock, etc., a superfluous and expensive staff is avoided and the men thus appointed, being generally practical farmers of known ability but non-resident in the locality, usually give every satisfaction.

Now that the Irish Department have made such successful progress, many points have been fairly demonstrated which are worthy of notice. Amongst these may be mentioned the marked success where the results have been attained by assisting private enterprise at a comparatively moderate cost in preference to the waste of funds and frequent blunders where such work was attempted by departmental bodies such as the aforesaid Congested Districts Board. Another point is the need of securing the co-operation of suitable local men. In Ireland where these endeavours at the outset were accompanied by more or less socialistic political ideas, one of the chief features in connection with such schemes was often a laudable effort to benefit small holders in remote districts; but as it is hard to assist a man who won't try to help himself the enterprise was thus frequently doomed to failure. It was subsequently found that, as a rule, the independent farmer of some means or resource was invariably the first to grasp such facilities as were afforded. There are few stock breeding districts where one or more farmers cannot be found who are ambitious to possess good breeding stock, and such are generally shrewd judges of the type of animal likely to suit the locality. Such men will go further, and pay better, for a good sire if they know that by doing so they are likely to get a premium, which will repay most of the extra outlay. A local breeder doing so for his own benefit invariably benefits his neighbours as well, not only by the introduction of good sires, but very often it happens that farmers are not slow to appreciate the fact of one of their number scoring a small advantage by his keenness and foresight, and a healthy competition is thus stimulated. Another mistake often made is the effort of departmental bodies to prematurely endeavour to force some new breed or type into a particular district. It would be preferable to select whatever breed seems most popular in a locality at the outset, and endeavour by granting small premiums, to encourage a spirit of enterprise.

Yours, etc.,

Potchefstroom. AMBROSE A. LANE.

DEPARTMENTAL NOTICES.

AVAILABLE PUBLICATIONS.

The following publications, amongst which are included several recent additions, can be had free of charge on application to the Editor, Department of Agriculture, Pretoria :—

Transvaal "Agricultural Journal," No. 3, Vol. I. (Published quarterly)
Transvaal "Agricultural Journal," No. 4, Vol. I. " "
Transvaal "Agricultural Journal," No. 5, Vol. II. " "
Transvaal "Agricultural Journal," No. 10, Vol. III. " "
Transvaal "Agricultural Journal," No. 13, Vol. IV. " "
Transvaal "Agricultural Journal," No. 14, Vol. IV. " "
Transvaal "Agricultural Journal," No. 15, Vol. IV. " "
Transvaal "Agricultural Journal," No. 16, Vol. IV. " "

Division of Botany :
- Leaflet No. 1.—" Plants Poisonous to Stock."
- Leaflet No. 3.—"Co-operative Experiments : Cotton."
- Leaflet No. 4.—" The Cockle-Bur " (English and Dutch).
- Bulletin No. 1.—" Conditions of Seed and Plant Distribution."

Division of Entomology :
- Leaflet No. 2.—" Orange Tree Butterfly " (English and Dutch).
- Leaflet No. 3.—" White Ants " (English and Dutch).
- Leaflet No. 4.—" Locust Report, July, 1906 " (English and Dutch).

Division of Forestry.
- " Price List of Seeds and Trees " (English and Dutch).

Division of Horticulture :
- Bulletin No. 1.—" Some Information about Fruit Trees " (English and Dutch).
- Leaflet No. 1.—" On Summer Pruning " (English and Dutch).
- Leaflet No. 2.—"On Thinning out Fruit."
- Leaflet No. 3.—" A Fruit Report " (English and Dutch).
- Leaflet No. 4.—" Diseases of Orange Trees " (English and Dutch).

Division of Publications :
- Bulletin No. 1.—" Burr-Weed or Boete Bosch."
- Bulletin No. 2.—" Some Diseases of the Horse."
- Bulletin No. 3.—" The Food of Plants."
- Bulletin No. 6.—" City and Town Milk Supply and the Care and Aeration of Milk " (English and Dutch).

Division of Veterinary Science :
- Bulletin No. 1—" Measles in Swine and Cattle " (English and Dutch).
- Bulletin No. 3—" Redwater " (English and Dutch).
- Bulletin No. 4.—" Epizootic Lymphangitis."
- Bulletin No. 5.—" Scab and its eradication."
- Bulletin No. 6. —" Contagious Abortion " (English and Dutch).
- Leaflet No. 3.—" Rhodesian Tick Fever " (English and Dutch).
- Leaflet No. 4,—Directions for taking Blood Smears.

Miscellaneous :
- Transvaal Forest Report.
- Agriculture within the Empire.
- Bulletin No. 1.—" The Brands Directory, 1904 " (English and Dutch).
- Bulletin No. 2.—" The Brands Directory, 1905 " (English and Dutch).
- Bulletin No. 1.—Department of Irrigation and Water Supply : The Design and Construction of Small Reservoirs for Irrigation and for Stock.
- Bulletin No. 2.—Department of Irrigation and Water Supply : The Design and Construction of Small Irrigation Canals.

JOURNAL FILES.

In order that our numerous readers may not be disappointed by being unable to complete their files, we would earnestly request them to preserve all copies of the "Journal," if they propose to bind them at the close of the year. Owing to the expense incurred in publication, it has become necessary to limit the number of copies issued, and it often happens that we cannot supply back numbers, as they are out of print.

Indices for the "Agricultural Journal," Vol. I., Vol. II., Vol. III. and Vol. IV. can be had on application to the Department of Agriculture.

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JOURNAL DUPLICATES.

Any readers who possess and can spare duplicates of the "Agricultural Journal" would confer a great favour by returning them to the Department of Agriculture, as back numbers are now out of print, and applications are constantly being made by persons desirous of completing their sets.

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ADDRESS.

Correspondents are earnestly requested to give their full name and correct postal address when forwarding any communication to the Department. It sometimes happens that readers send their farm address only, and fail to give the Post Office address, consequently it is impossible to reply to their queries or send publications. This refers more especially to farmers applying for cattle permits, as in many cases letters forwarded by the Veterinary Division are returned by the Postal Authorities to the effect "Not delivered. Address insufficient." The Department should also be immediately notified of any change of address.

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APPLICATIONS FOR THE JOURNAL AND NON-DELIVERY.

Applications to be placed on the Mailing List of the "Journal," as well as complaints as to non-delivery of the "Journal," should be addressed to the Government Printer, P.O. Box 373, Pretoria, and not to the Editor of the "Journal." It is particularly requested that changes of address should also be promptly notified to the Government Printer, in order to ensure prompt delivery to addressees and to avoid unnecessary correspondence.

The "Agricultural Journal" is distributed free in the Transvaal only, and the attention of subscribers in the other South African Colonies and oversea is kindly requested to the Government Printer's Notice on the tinted page at the commencement of this number.

DAVID POLLOCK,

Acting Editor, Transvaal Agricultural Journal.

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ADDITIONS TO THE LIBRARY OF THE DEPARTMENT.

South Africa.

The Transactions of the South African Philosophical Society—
- Vol. X.—Part III., 1898.
- Vol. XI.—Part I., 1900.
- Vol. XII.—(Pp. 1–563).

Trade of the Colonies and Territories forming the South African Customs Union, for six months ended June 30, 1906.

Cape Colony—
- Enforcement of Nurseries and Quarantine Act, February, 1906.
- Fumigation of Plants in Nursery Rows, February, 1906.
- Instructions for Fumigation of Nursery Stock with Hydrocyanic Acid Gas, February, 1906.
- The Agricultural Journal.

Natal—

Notes on Agriculture in Natal, 1905.

Report of the Secretary, Minister for Agriculture, for the year ended 30th June, 1905.

The Agricultural Journal.

Orange River Colony—

Leaflet No. 1—Some Notes on the Destruction of certain Vermin which Cause Injury and Loss to Farmers, with Suggestions as to the Formation of Poisoning Clubs.

" No. 2—The Parasite of Common Sheep Scab.

Transvaal.—

Report of the Secondary Education (Johannesburg) Commission.

Report of the Commission, Weights and Measures, 1906.

Transvaal Census, 1904.

Supplementary Tables in respect of the Population of the Districts and Wards defined by Proclamation No. 42 (Administration), 1904.

The Agricultural Journal.

Rhodesia—

The Agricultural Journal.

GREAT BRITAIN.

Board of Agriculture and Fisheries—

(i.) Agricultural Statistics, 1905.

(ii.) Annual Reports of the Proceedings under the Diseases of Animals Acts. The Markets and Fairs (Weighing of Cattle) Acts.

Leaflet No. 160—The Cultivation of Lucerne.

" No. 161—The Vapourer Moth.

" No. 162—Grafting Fruit Trees.

" No. 163—White Rust of Cabbage.

" No. 164—Potato Leaf-Curl.

" No. 165—Gall-gnats injurious to Willows and Osiers.

" No. 166—Some Common Thistles.

Royal Botanic Gardens, Kew—

Bulletin of Miscellaneous Information, 1902.

University of Leeds and the Yorkshire Council for Agricultural Education—

No. 57.—Report on the Nationalities and Varieties of Red Clover.

The West of Scotland Agricultural College—

(i.) Reports on Experiments on the Growth of Sugar Beet; the Destruction of Runch and Sharlock in Corn Crops, etc. (4th and 5th Annual Report).

(ii.) Reports on the growth of Sugar Beet; the Seeding of Pastures, etc. (6th Annual Report).

Prospectus of Instruction, University College, Reading.

The Rothamsted Experimental Station—

Rothamsted Memoirs, by Lawes and Gilbert—

I. Vol. I.—Experiments on Vegetation.

Vol. II.—Experiments on Permanent Grass-Land.

Vol. III.—Experiments on Animal Composition.

II. Vol. I.—Field Experiments.

Vol. II.—Field Experiments.

Vol. III.—Field Experiments.

Vol. IV.—Feeding Experiments.

Vol. V.—Field Experiments.

Vol. VI.—Field Experiments.

Vol. VII.—Field and Feeding Experiments.

History and Present Position of the Rothamsted Investigations. By Professor J. H. Gilbert, Ph.D., LL.D., F.R.S.

Plans and Summary Tables arranged for Reference in the Fields, 1905.

Memoranda of the Origin, Plan, and Results of the Field and other Experiments conducted on the Farm and in the Laboratory of the late Sir John Bennet Lawes, Bart., at Rothamsted, Herts, by Sir J. H. Gilbert, F.R.S.

British Association for the Advancement of Science..
Report, South Africa, 1905 (Seventy-fifth Meeting)—
Part II.—Canine Piroplasmosis.
Part III.—Canine Piroplasmosis.
Part IV.—Canine Piroplasmosis.
George F. A. Nuttall and G. S. Graham-Smith.
The Wensleydale Flock Book, Vol. XVII.

INDIA.

Records of the Botanical Survey of India—
Vol. IV., No. 3—An Epitome of the British Indian Species of Impatiens. By Sir J. D. Hooker, 1906.
Report on the Season and Crops of Eastern Bengal and Assam for the year 1905–6.
Annual Report of the Sibpur Experimental Farm and Agricultural Classes for 1904–5.
Annual Report of the Department of Land Records in the Bombay Presidency for the year 1904–5.
Annual Report of the Burdwan Agricultural Station for the year 1904–5.

CANADA.

Department of Agriculture.

Branch of the Dairy Commissioner—
Bulletin No. 4—Some Phases of Dairying in Denmark.
,, No. 5—Improvement in Dairy Herds.
,, No. 6—Chemical Investigations relating to Dairying undertaken in 1904.
,, No. 7—List of Exporters of some Canadian Products.
,, No. 8—Water-contents of Butter.
,, No. 9—Instructions for Testing Individual Cows, with some Notes on the Use of the Babcock Milk Tester.

Poultry Division—
Bulletin No. 7—Profitable Poultry Farming.
,, No. 8—Farmer's Poultry House.
,, No. 9—Diseases and Parasites of Poultry.

Seed Division—
Bulletin No. S1—The Seed Control Act. 1905, with General Explanations and Instructions and Rules and Methods for Seed Testing.
,, No. 8—Conditions of the Trade in Timothy Alsike and Red Clover Seeds, Results of Investigation, 1902.
,, No. 15—An Act respecting the Inspection and Sale of Seeds, with Explanations and Comments.
Summary of Illustrated Lectures on Seed Grain.

Branch of the Live Stock Commissioner—
Bulletin No. 10—The Production of Bacon for the British Market.

Women's Institutes—
Bulletin No. 146—Uses of Fruits, Vegetables, and Honey.

Ontario Bureau of Industries—
Crop Bulletin No. 90.—Crop Report, November, 1905.
,, ,, No. 91.—Crops and Live Stock of Ontario.

Canadian Seed Growers' Association—
(i.) Catalogue of Selected Seed, 1906.
(ii.) The Improvement of Farm Crops.
(iii.) Report of the Second Annual Meeting held at Ottawa, June 27, 28, 29, 1905.

Province of Ontario—
(i.) Annual Report of the Bee-keepers' Association, 1905.
(ii.) First Annual Report of the Vegetable Growers' Association, 1905.
(iii.) First Annual Report of the Poultry Institute, 1905.
(iv.) Annual Reports of the Dairymen's Associations, 1905.

Canadian Stockbreeders' Association—
(i.) First Annual Convention of the National Association of Canadian Stockbreeders, held in the City Hall, Ottawa, March, 1904.
(ii.) Second Annual Convention of the Canadian National Live Stock Association, held in the Imperial Buildings, Ottawa, April, 1905.

Select Standing Committee on Agriculture and Colonization—
Evidence of Dr. Charles E. Saunders, on Milling Tests of Wheat, New Varieties of Cereals.
Evidence of Mr. G. H. Clark, on Selection of Seed Grains, Crop Growing.
Evidence of Dr. James Fletcher, on The Division of Insects and Plants.
Evidence of Mr. Frank T. Shutt, on Fertilizers, Ensilage, Feeds.
Evidence of Mr. J. A. Ruddick, on Dairying, Cold Storage, Extension of Markets.
Evidence of Mr. W. T. Macoun, on Fruit Culture and Potato Growing.

AUSTRALIA.

Victoria—
The Year Book of Agriculture for 1905.

New South Wales—
A Critical Revision of the Genus Eucalyptus, in six parts (I. to VI.) J. H. Maiden.
The Forest Flora of New South Wales, Part 1, Vol. III. (Part XXI. of the complete work). J. H. Maiden.

Tasmania—
Bulletin No. 7—The Poultry Industry in Tasmania.

NEW ZEALAND.

Department of Agriculture.

Dairying Division—
Bulletin No. 6—(i.) The Care and Treatment of Milk.
(ii.) Testing Dairy Herds.
Annual Report, 1904-1905.

Division of Biology and Horticulture—
Bulletin No. 7—Potato Diseases.
,, No. 8—Nitrogen-fixing Bacteria.
,, No. 9—Meteorology in Relation to Farming.
,, No. 10—Canker of Fruit Trees.
,, No. 11—Club-rot of Cabbage.
,, No. 12—Hollyhock Rust.
,, No. 13—The Gum Tree Scale.
,, No. 14—Disease of Swede Turnip.
,, No. 15—Bean Diseases.
Technical Papers, No. 1—A. The Facultative Saprophytism of Alternaria Solani.
B. On Termites.
Thirteenth Report, 1905.

Experimental Stations—
Reports for the year 1905.

Leaflets for Gardeners and Fruit Growers—
No. 48—Onion Mildew.
No. 49—American Blight or Woolly Aphis.
No. 50—Diseases of Roses.
Report of the Department of Agriculture for the year 1905.
Poultry and Eggs for the Market and Export by D. D. Hyde, Chief Poultry Expert.

WEST INDIES.

Imperial Department of Agriculture—
Bulletin No. 39—Sugar Cane in the Leeward Islands, 1904–5.
,, No. 40—Seedling Canes and Manurial Experiments at Barbadoes, 1903–5.
,, No. 41—Tobago, Hints to Settlers.
,, No. 42—Manurial Experiments with Sugar Cane in the Leeward Islands, 1904–5.

BRITISH EAST AFRICA.

Department of Agriculture, Nairobi—
Leaflet No. 16—Cotton.

UNITED STATES OF AMERICA.

United States Department of Agriculture.

Bureau of Forestry—
Bulletin No. 56—Forest Lands in Berkeley County, South Carolina, 1905.
„ No. 57—Federal and State Forest Laws, 1904.
„ No. 58—The Red Gum, 1905.
„ No. 59—The Maple Sugar Industry, 1905.
„ No. 60—Report on an Examination of a Forest Tract in Western North Carolina, 1905.
„ No. 61—Terms used in Forestry and Logging, 1905.
„ No. 62—Grazing on the Public Lands, 1905.
„ No. 63—The Natural Replacement of White Pine on Old Fields in New England.
„ No. 64—Loblolly Pine in Eastern Kansas, 1905.
„ No. 65—Advice for Forest Planters in Oklahoma and Adjacent Regions, 1906.
„ No. 66—Forest Belts of Western Kansas and Nebraska.
„ No. 67—Forest Reserves in Idaho, 1905.
„ No. 68—A Working Plan for Forest Lands in Central Alabama.
Reports of the Forester for 1905.

Office of Experiment Stations—
Vol. XVII.—Experiment Station Record Nos. 8 and 9, April and May, 1906.

Alaska Agricultural Experiment Station—
Bulletin No. 2—Vegetable Growing in Alaska.

Arizona Agricultural Experiment Station—
Bulletin No. 52—Alfilaria, Erodium Cicutarium, as a Forage Plant in Arizona, 1906.

California Agricultural Experiment Station—
Bulletin No. 172—Further Experiments in Asparagus Rust Control.
„ No. 173—Commercial Fertilisers.
„ No. 174—A New Wine Cooling Machine, 1906.
„ No. 175—Tomato Diseases in California, 1906.
Partial Report of Work for the years 1895–96, 1896–97.
Report of Work for the years 1898–1901—Part II.

Colorado Agricultural Experiment Station—
Bulletin No. 114—Insects and Insecticides, 1906.

Connecticut Agricultural Experiment Station—
Twenty-ninth Annual Report, 1905.
Fifth Report of the State Entomologist, for the State of Connecticut—Part IV.
Bulletin No. 38—The Marketing of Poultry Products.
„ No. 39—Pig Feeding Experiments.

Florida Agricultural Experiment Station—
Bulletin No. 82—A Preliminary Report on Growing Irish Potatoes, 1906.
„ No. 83—Pineapple Culture, III., Fertiliser Experiments, 1906.
„ No. 84—Pineapple Culture, IV., Handling the Crop, 1906.
„ No. 85—Second Report on Pecan Culture, 1906.

Hawaii Agricultural Experiment Station—
Bulletin No. 11—The Black Wattle in Hawaii, 1906.
„ No. 12—The Mango in Hawaii, 1906.
„ No. 13—The Composition of some Hawaiian Feeding Stuffs.
Experiment Station of the Hawaiian Sugar Planters' Association.—Division of Agriculture and Chemistry—
Bulletin No. 16—The Influence of Stripping on the Fields of Cane and Sugar, 1906.

Idaho Agricultural Experiment Station—
Bulletin No. 54—Department of Horticulture. Picking, Packing, and Marketing the Apple, 1906.

Kansas Agricultural Experiment Station—
Bulletin No. 134—The Alfalfa Seed-crop and Seeding Alfalfa, 1906.
,, No. 135—Grading Cream.
Eighteenth Annual Report for the Fiscal year 1904–5.

Kentucky Agricultural Experiment Station—
Bulletin No. 120—(i.) Some Trees and Wood-infesting Insects.
(ii.) Cabbage Snakes, 1905.
,, No. 121—Commercial Fertilisers.
,, No. 122—(i.) Corn: A Method of Selecting Seed Corn.
(ii.) A Chemical Study of the Composition of a number of varieties of Kentucky Corn.

Hatch Agricultural Experiment Station, Massachusetts—
Bulletin No. 108—Inspection of Concentrates, 1906.

Michigan Agricultural Experiment Station—
Bulletin No. 235—Succotash as a Soiling Crop.

New Hampshire Agricultural Experiment Station—
Bulletin No. 120—The Dairy Industry in New Hampshire.
,, No. 121—The Gypsy Moth in New Hampshire, 1905.
,, No. 122—The Brown-tail Moth in New Hampshire, 1906.
,, No. 123—Inspection of Fertilizers in 1905.
Sixteenth Annual Report.

New York Agricultural Experiment Station.
Bulletin No. 277—The Bang Method of Controlling Tuberculosis, with an Illustration of its Application, 1906.
,, No. 278—Varieties of Raspberries and Blackberries with Cultural Directions, 1906.
,, No. 279—Potato Spraying Experiments in 1906.

North Dakota Agricultural Experiment Station—
Bulletin No. 68—Department of Botany; Rust Problems, Facts, Observations, and Theories. Possible Means of Control.

South Dakota Agricultural Experiment Station—
Bulletin No. 94—Alfalfa and Red Clover, 1906.
,, No. 95—The Treatment of Nail Pricks of the Horse's Foot, 1906.
,, No. 96—Forage Plants and Cereals at Highmore Sub-Station.

Tennessee Agricultural Experiment Station—
Bulletin No. 3—(i.) Alsike Clover.
(ii.) Ill effects sometimes produced on Horses and Mules pastured exclusively on Alsike.
,, No. 4—The Control of Insects, Fungi, and other Pests.

Texas Agricultural Experiment Station—
Bulletin No. 79—Cotton Breeding.
,, No. 80—Peach Growing in Texas.

Vermont Agricultural Experiment Station.
Bulletin No. 123—Commercial Fertilisers.

Virginia Agricultural Experiment Station—
Bulletin No. 158—Milk Fever, its Causes, Symptoms, and Successful Treatment.

Wisconsin Agricultural Experiment Station—
Twenty-second Annual Report for the year ending June 30th, 1905.
Bulletin No. 127—The Principles and Practice of Horse Breeding.
,, No. 128—A Swiss Cheese Trouble caused by a Gas-forming Yeast.

Bulletin No. 129—Some Creamery Problems.
,, No. 130—Licensed Commercial Feeding Stuffs, 1905.
,, No. 131—Official Tests of Dairy Cows, 1904–5.
,, No. 132—The Manufacture of Whey Butter at Swiss Cheese Factories.
,, No. 133—Distribution of Tuberculosis in Suspected and Non-suspected Herds in Wisconsin.
,, No. 134—Licensed Commercial Fertilisers and Feeding Stuffs.
,, No. 135—The Spraying of Potatoes for Prevention of Leaf Blight and Rot.
,, No. 136—Practical Directions for Preserving Native Fruits and Vegetables
,, No. 137—Conditions which affect the Time of the Annual Flowering of Fruit Trees

Wyoming Agricultural Experiment Station—
Bulletin No. 69—Digestion Experiments with Wethers, 1906

* * *

*GOVERNMENT STALLIONS FOR PUBLIC STUD.

Applications to hire stallions for next season should be made before July 15th, on which date these applications will be considered.

As the number of stallions is limited, preference will be given to owners of the best class of mares.

TERMS.

The season will commence on the 1st September.

Stallions will be leased to individuals, associations, or two or more breeders in conjunction, approved of by the Department.

The Lessee or Lessees to allow the farming public to send mares for service at a fixed fee, provided the list is not already full, the fees to be according to the following tariffs, viz.:—

Prices paid for hire of Stallion.	*Fee to be charged by Lessee not to exceed*
£25	30s.
£30	35s.
£40	45s.
£50	55s.
£60	65s.

The charge for the hire of the majority of the stallions will range from £25 to £35, but for a few exceptionally high-class animals somewhat higher rates will be made.

Payment for hire of stallions to be made in advance.

Not more than 40 mares to be served by a stallion without written permission.

Stallions will be delivered by the Department at the nearest railway station to the place where they are to stand at stud, and expense of railage will be borne by the Department. At the termination of the season, the stallion will be taken over by the Manager of the Government Stud Farm, or his representative.

Stallions will not be allowed to run with mares unless by special arrangement.

Due care must be taken that stallions shall not serve mares suffering from any contagious diseases.

The Manager of the Stud Farm or his representative to have the right to inspect the stallions leased at any time.

In the event of a stallion dying during the period for which he has been leased, from any cause through which the Lessee is to blame, the Lessee will be liable for a sum equal to the price already paid for the hire of same.

The Lessee to be responsible for the good care and attention of the stallion and his equipment.

Should any of the foregoing rules not be complied with, the Department shall have the right to remove the stallion at once, and to take any action desirable for the recovery of damages, the Lessee to forfeit the money paid for hire.

Applications must be addressed to the Manager, from whom any further information can be obtained.

F. B. SMITH,
Director of Agriculture.

A. MCNAE,
Acting Manager.

* This notice has already appeared in the daily press.—*Editor.*

DIVISION OF FORESTRY.

Tariff for Poles and Firewood from Groenkloof Plantation, Pretoria.

It is notified for general information that the Groenkloof Plantation having been transferred to the Municipality, all applications and correspondence in connection therewith should be addressed to the Town Engineer, Pretoria, and not to the Department of Agriculture.

* * *

PRICE LIST OF TREES AND SEEDS.

The price list of trees and seeds supplied by this Division, which was printed in full under "Departmental Notices" in the last number of the "Journal," has now been issued as a separate publication, and can be obtained free of charge on application to the Conservator of Forests, or the Editor, Department of Agriculture, Pretoria.

* * *

NOTICE No. 542 of 1906.

GRANTS-IN-AID OF TREE PLANTING.

It is hereby notified that the Government is prepared to contribute towards the expenses of Tree Planting, undertaken by Municipalities, Agricultural Societies, and other Public Bodies.

The conditions under which the grant will be made are:—

(1) There shall be submitted to the Director of Agriculture for approval, as soon as possible after the 1st of July in each year, a plan of the place or places or streets where it is intended to plant, a list of the kinds of trees to be planted, and also an outline of the methods to be employed in preparing the ground for the trees and for protecting them. The total number of trees to be planted and the total estimated cost should be stated.

(2) The completed work shall be inspected and compared with the approved working plan, and for any unauthorised departure from the plan submitted to be approved by the Director of Agriculture a deduction may be made from the expenditure account.

(3) Street trees shall not be planted on the pavement or furrow or be spaced nearer than 15 feet apart. They must be securely fenced.

(4) Different kinds of trees shall not be mixed.

(5) Plantations shall be protected against fire.

(6) A separate account shall be kept of all monies expended on tree planting, and shall always be open for Government inspection, and a statement of accounts signed by the Chairman and Secretary and countersigned by the local Magistrate shall be submitted to the Director of Agriculture not later than the 1st of June in each year, so that the grant may be paid before the end of the financial year (June 30th).

(7) On approval of the Director of Agriculture, or his Deputy, of the work undertaken, and of the accounts for the same, a sum (not exceeding £100 for any one body) equal to half the total expenditure incurred in tree planting shall be refunded to the Municipality, Agricultural Society, or other Public Body concerned.

(8) As the money available for this scheme is limited, applications will be dealt with in the order in which they are received, till the whole sum has been allotted.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture,
Department of Agriculture,
Pretoria, September, 1906.

DIVISION OF BOTANY.

Seed Distribution.

A list of seeds available for farmers who are willing to conduct experiments in co-operation with the Division has been published as Bulletin No. 1, and may be obtained on application to the Editor. Terms on which the seeds will be issued, are stated in the Bulletin, and application forms will be found within the cover. Notes are given as to the uses of the plants and as to how the seed should be treated.

COCKLE-BURR.

On account of the dangerous character of this weed, to wool and mohair growers, farmers on the Aapies, Pienaar's and Crocodile Rivers are advised to keep a sharp look out for its appearance, especially on the banks of the rivers, and to root out the plants before they go to seed.

Leaflet No. 4, giving an illustration of this weed, will be sent free of charge on application to the Editor. Any farmer who is in doubt as to the identity of Cockle-Burr can send specimens to the Botanist for identification

* * *

DIVISION OF CHEMISTRY.

Instructions for the Sampling of Soils.

In taking soil for analysis it is of the utmost importance that a truly representative sample be secured, otherwise the labour involved will, to a great extent, be wasted.

Much depends upon the particular object for which the analysis is to be made. If the soil of a farm or field is to be reported upon, and much difference exists in the soil from different parts, each variety of soil should be represented in the final sample by a quantity proportional to the aliquot portion of the whole area covered by that particular soil.

If great differences are known to exist in different parts of the farm or field better knowledge of the nature of the soil will be obtained, of course, at the cost of greater labour in analysis, if the samples are kept separate.

The *depth* to which a sample is taken is also a matter of importance. In some cases a clear line of separation between the soil proper and the sub-soil is perceptible. This is often shown by difference in colour, the soil being richer in organic matter, and therefore darker than the sub-soil. Under such circumstances, the sample of soil should be taken down to the line and, if necessary, a sample of sub-soil should also be secured. When no distinction is perceptible, the sample should be taken to the depth of one foot.

Methods of Taking Samples.

There are many ways of taking samples of soil. The following, perhaps, will be found most convenient in this country :—

(1) Having selected a representative spot, the vegetation upon it is removed, and a hole is dug with a sharp spade to a depth rather greater than that of the soil proper, or, if no line of separation of soil from sub-soil is perceptible, to about 15 inches. One side of the whole is then trimmed with the spade so as to be smooth and vertical, the hole being cleaned out. A slice of uniform thickness, about 3 or 4 inches, is then removed by the spade down to the necessary depth. This slice is placed on a clean board or sack and mixed with similar slices, obtained in the same way from other parts of the field. Finally, all the samples are thoroughly mixed together with a trowel or the spade, the sticks, large stones, and roots removed, and a portion of six or seven pounds placed, with a label giving details, in a clean box and sent for analysis.

(2) Another, better but more laborious, method is to have wooden boxes, six inches square and 12 inches deep, to hold the samples. A large hole is dug with a spade at the selected spot, and a square upright block of soil is left in its centre. This is carefully trimmed with the spade until a box will just fit over it. The upper surface of the block of soil is freed from vegetation, the box inverted over it, and forced down. The spade is next slipped under, and the box with its contents removed, a label giving particulars of the soil put in, and the lid screwed on. In this way a sample of the soil (and often the sub-soil, *in situ*) is obtained, which can be examined in the laboratory.

What to do with the Samples.

In all cases full details as to the exact locality, date of collection, depth, crops borne, previous manurial treatment, and other circumstances connected with the soil should be enclosed with the sample. These should be written in pencil, as ink is apt to become damp and run.

Samples should be sent by passenger rail, addressed to me at the Agricultural Chemical Laboratories, Pretorius Street, Pretoria, and advice of their despatch, together with details of the samples, should be sent by post to the same address.

While every effort will be made to deal with the samples as soon as possible, for a time, at least, some delay may be unavoidable, owing to the large accumulation of material awaiting analysis. *No attention will be paid to samples sent without the full details stated above.*

A list of charges for the analysis of soil and other products is published below, but in cases where it is considered that the results may be of sufficiently general interest, if published, no charge will be made.

Herbert Ingle,
Chief, Division of Chemistry.

* * *

SCHEDULE OF CHARGES FOR ANALYSIS MADE IN THE AGRICULTURAL LABORATORIES.

		£	s.	d.
1.	Estimation of one constituent in a manure or feeding stuff ..	0	7	6
2.	Estimation of two or three constituents in a manure or feeding stuff	0	15	0
3.	Complete analysis and valuation of a manure or feeding stuff..	1	0	0
4.	Analysis of water—drainage or irrigation	1	5	0
5.	Partial analysis of a soil to determine fertility and manurial needs	2	0	0
6.	Complete analysis of a soil	3	0	0
7.	Analysis of milk, cream, butter, or cheese	0	10	0
8.	Milk—determination of fat and total solids	0	5	0
9.	Milk—determination of fat only	0	2	6
10.	Butter—determination of water and fat	0	5	0
11.	Analysis of a vegetable product—hay, ensilage, roots, etc. ..	1	0	0

At present no charge will be made to *bona fide* farmers. The charges in the above schedule refer to products sent by manure merchants, milk dealers, or others interested in trade. Samples will only be accepted if assurance can be given that they are properly taken and truly representative of the bulk. The right of publishing the results of any analysis is reserved by the Department. Should the examination of any product furnish results which are deemed of sufficient general interest, the charges may be remitted.

Samples of any product likely to be of agricultural importance will gladly be received.

* * *

SPONZIEKTE OR QUARTER EVIL.

Vaccine for the prevention of this disease is now ready for issue at the Government Veterinary Bacteriological Laboratory, and can be obtained through the Government Veterinary Surgeons, who will give instruction in the method of vaccination, and through whom also the necessary instruments can be obtained. The price of the vaccine is 3d. per double dose.

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LIST OF OFFICIALS.

The following is a list of the officials of the Transvaal Department of Agriculture, to whom inquiries respecting matters connected with agriculture may be addressed :—

Director .... F. B. Smith
Assistant Director .... A. C. Macdonald
Division of Veterinary Science :
(*a*) Bacteriology .... A. Theiler
(*b*) Contagious Diseases .... C. E. Gray

Division of Chemistry .... HERBERT INGLE
Division of Botany .... J. BURTT-DAVY
Division of Forestry .... CHARLES E. LEGAT
Division of Entomology .... C. B. SIMPSON
Division of Horticulture .... R. A. DAVIS
Division of Publications .... WILLIAM MACDONALD
Division of Poultry .... REGINALD BOURLAY
Tobacco Division .... J. VAN LEENHOFF
Government Stud Farm, Standerton .... A. MCNAE
Government Experimental Farm, Potchefstroom .... ALEXANDER HOLM
Government Experimental Farm, Ermelo .... H. NICHOLSON
Translator .... OTTO MENZEL
Registrar of Brands .... J. J. PIENAAR

* * *

ASSISTANCE IN IMPORTATION OF BREEDING STOCK.

Notice is hereby given that with the object of encouraging the importation of breeding stock into the Transvaal Colony the Government is prepared to grant assistance to *bona-fide* farmers as follows:—

1. A grant, not exceeding £20 to any individual, towards defraying half the cost of railage from any station in South Africa to any station in the Transvaal on sheep and Angora goats imported solely for breeding purposes and being the property of the applicant.
2. Claims to be supported by a duly receipted voucher of the Railway Department at place of entraining.
3. Applicants for this refund to undertake to preserve and maintain the said stock for a period of not less than two years from date of payment of the grant.
4. Applicants must agree not to sell, or otherwise dispose of, or slaughter any of the stock without the permission of the Commissioner of Lands. Permission to slaughter to be given only in the event of the stock proving incapable of breeding.
5. Failing the faithful observance of the conditions the Commissioner of Lands shall call upon the farmer for an immediate refund of the grant.
6. In cases of dispute the decision of the Commissioner of Lands to be accepted as final.
7. Applications for the grant to be made through the local Magistrate or Resident Justice of the Peace, who will furnish a form to be completed and forwarded to the Director of Agriculture for consideration.
8. If desired the stock can be carried on any of the South African Railways at the expense of the Government provided an amount equal to half the cost of such railage be first deposited with the Director of Agriculture.
9. As the amount of these grants is limited to the sum of £2,000 in the present financial year, applications will be dealt with in the order in which they are made.

F. B. SMITH,
Director of Agriculture.

Department of Agriculture,
Pretoria, 31st August, 1905.

* * *

SUMMARY OF DEPARTMENTAL INSTRUCTIONS FOR THE GUIDANCE OF STOCK INSPECTORS AT TRANSVAAL PORTS OF ENTRY.

(*Animals will be inspected only between the hours of sunrise and sunset.*)

No. 1.—CATTLE.

No cattle will be admitted into the Transvaal by road or rail unless the owner has previously applied for and obtained a written permit from the Department of Agriculture, Pretoria. This permit must be presented to the Stock Inspector along with the animals at the Ports of Fntry specified in the permit.

In making application for this permit the following particulars must be furnished:—Name of owners; locality from which the cattle come; purpose for which

they are being introduced; number of animals to be introduced (if coming by; rail station at which they are to be trucked; station at which they are to be derailed); name of consignee and ultimate destination of the animals. These particulars are required for the information of the Advisory Committee of the Ward or District into which the cattle are to be introduced, by whom all permits have to be recommended before they are issued.

SLAUGHTER CATTLE will be branded at the Port of Entry with the brand S *on the left side of the neck before proceeding to their destination if this has not been already done by the consignor before shipment.*

No. 2.—Equines.

All persons introducing equines into the Transvaal must produce certificates for their animals signed by a qualified Veterinary Surgeon holding the Diploma of the Royal College of Veterinary Surgeons, England, stating that the animals are free from disease and that they have been tested with mallein and have reacted in a normal manner. These certificates will be collected by the Stock Inspector at the Port of Entry. If any horse is presented for admission without a certificate it will either be tested with mallein by the Stock Inspector and allowed to enter after the Inspector is satisfied that the animal is free from disease, or it may be allowed to proceed to its destination and tested there, whichever course is most convenient for the Department

Exceptions.

Equines which are engaged in to and fro movements across the border. Equines which have recently come from the Transvaal and are returning thither.

Racehorses in training will be allowed to proceed to their destination upon the owner giving an undertaking to report their arrival to the Government Veterinary Surgeon of the District, and to submit the imported animals to the mallein test if the Government Veterinary Surgeon considers this necessary. All other equines will be detained and tested unless the owner has previously made other arrangements with this Department.

No. 3.—Sheep.

Sheep are subject to examination at the Port of Entry and liable to detention if found affected with scab.

No. 4.—Pigs.

Pigs from Cape Colony are now allowed to enter the Transvaal if the following conditions are observed:—The person desiring to introduce swine into this Colony from Cape Colony shall make application to the Director of Agriculture, Pretoria, stating the place from which and the person from whom the swine are being obtained, and giving particulars as to their number, destination, and the purpose for which they are being introduced; he shall further submit with such application a certificate signed by the Chairman of local authority of the district from which the animals are to be brought and endorsed by the Chief Veterinary Surgeon or his representative to the effect that such swine are free from swine fever, and that there has been no swine fever in the place from which they have been immediately obtained.

Upon receipt of such documents the Director of Agriculture may grant and transmit a permit authorising the introduction of such swine. Such permit shall be sent with the animals, and shall be handed over to the Stock Inspector at the Port of Entry.

Permits for the introduction of pigs from other Colonies are not required.

C. E. GRAY,

Principal Veterinary Surgeon.

* * *

GOVERNMENT STUD FARM, STANDERTON.

Horse Breeding. Season, 1906–7.

Mares may be sent to the Thoroughbred Stallions that are standing at the Government Stud Farm during the present season.

Mares can remain on the Farm during the season if their owners wish them to do so. (This arrangement will be of especial value to Mares from Horse Sickness Districts.)

Charges: For Grazing Mares 5s. per month. For Stabled Mares 1s. per day. Inclusive of attendance.

Mares will receive every care and attention, but no liability can be accepted.

Stud cards, giving Stud Fees and particulars of the Stallions, may be procured from the Manager, from whom any further information can also be obtained.

Postal Address: **Telegrams:**
A. McNae, **"Horses,"**
Acting Manager, Government Stud, Standerton. **Standerton.**

SPECIAL RAILWAY RATES.

Mares that have been sent from any railway station in the Transvaal to the Government Stud Farm, Standerton, will—if returning to the same station within a period of three months—be carried over The Central South African Railways free of charge, on production of a Certificate signed by the Manager, Transvaal Government Stud, stating that the Mares have been to the Farm for Breeding purposes.

Mares will be met at Standerton provided two days' clear notice of the time of their arrival is sent to the Manager of the Stud Farm.

F. B. SMITH,
Director of Agriculture.

* * *

NOTICE.

It is hereby notified for general information that the Department has been advised by the Commissioner, Nairobi, British East Africa, that sheep and goats may now be imported from the South African Colonies into British East Africa if accompanied by a Veterinary Certificate certifying that the animals are in good health.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture.
Pretoria, October 1st, 1906.

* * *

POISONOUS PLANTS.

The Division of Botany and Division of Veterinary Science are carrying on a series of joint investigations on the poisonous plants of the Colony, their effect on stock, and the remedies to be applied.

Last year we invited farmers to send specimens of poisonous plants for identification, and are glad to be able to extend the invitation this year.

Any farmer who has poisonous plants on his farm, and would like information about them, may send samples to the Department for investigation. These samples will be identified and named, will be tested on animals kept for the purpose, the symptoms will be carefully diagnosed, and different remedies will be tested. A report of the results will be sent to the person furnishing the specimens.

For an effective test, samples of at least 5 lbs. of the material should be sent, but smaller samples will also be welcome for identification and preliminary report.

Through the courtesy of the Postmaster-General, specimens may be sent by post, free of charge, if fastened up as letters and addressed:—

O.H.M.S. Letter Post.
The Government Botanist,
Department of Agriculture,
P.O. Box 434,
Pretoria.

* * *

CO-OPERATIVE EXPERIMENTS: COTTON.

COTTON-SEED DONATED BY THE BRITISH COTTON GROWING ASSOCIATION.

The Department has received a large consignment of American Upland Cotton Seed from the British Cotton Growing Association. This seed will be distributed to any *bona-fide* farmer who wishes to give the crop a trial, in sufficient quantity to sow one acre (209 x 208 English feet).

The amount of seed required will be as follows:—

For the Lowveld, sowing 4 x 3 feet, 3 lbs. of seed.
,, Middleveld ,, 4 x 1½ ,, 5 to 6 lbs. of seed.
,, ,, ,, 4 x 1 ,, 7 to 9 ,, ,,
(the thicker sowing is advisable at higher altitudes where the climate is rather cooler).

The farmer is required to pay all carriage and transport charges from Pretoria to his farm (freight from America to Pretoria has been paid by the Association and the Department).

The farmer must sign and return the attached form of agreement either to the Government Botanist or to the Resident Magistrate.

This agreement is made necessary by the conditions under which the Association has supplied the seed. These conditions read: "That all the cotton grown from this seed shall be shipped to the Association for sale, and if the experiment proves successful the cost of the seed shall be refunded to the Association, that other experiments may be conducted; . . . "if the experiments are a failure they (the farmers) will be called upon to pay nothing; if successful, the Association will dispose of the Cotton for their account, and deduct the cost from the proceeds."

The Association has agreed to supply the Department with two hand-gins, which we intend to loan out to each distrct. Application for the use of these gins should be made in due course to the Resident Magistrate.

A pamphlet entitled "Hints on the Cultivation and Harvesting of Cotton," has been issued by the British Cotton Growing Association; a few copies are still available, one of which will be sent to each farmer receiving seed, as long as the supply holds out.

For further information on Cotton Cultivation, etc., growers are referred to the articles and notes which have appeared in the *Transvaal Agricultural Journal* during the last 18 months, particularly the following:—

Cotton Growing in the Transvaal: *Agricultural Journal* No. 12, p.p. 739–745. (July, 1905.)
Cotton as a Possible Crop for the Transvaal: No. 8, pp. 595–599. (July, 1904).
How to Estimate the Yield of Cotton-lint per Acre: No. 9, p. 174.
Weight of a Bale of Cotton: No. 9, p. 174.
Transvaal Cotton; Reports from the Imperial Institute: No. 9, pp. 136–137; No. 11, pp. 554–556.
Cotton in South Africa: No. 9, pp. 130–131.
Transvaal Native Cottons: No. 9, p. 131 and pp. 136–137.
Cotton in the Lowveld of the Eastern Transvaal: No. 10, p. 316.
Zoutpansberg Cotton: No. 9, pp. 136–137; No. 11, p. 554.
Swaziland Cotton: No. 9, p. 137.
Cotton in the Marico and Rustenburg Districts: No. 12, pp. 863–864 and 842.
Cotton at Malelane: No. 13, October, 1905, p.p. 152–155.

JOSEPH BURTT-DAVY,
Government Agrostologist and Botanist.

THE GOVERNMENT AGROSTOLOGIST AND BOTANIST,
TRANSVAAL DEPARTMENT OF AGRICULTURE,
P.O. Box 434,
PRETORIA.

CO-OPERATIVE EXPERIMENTS: COTTON.

SIR,

Please forward me by *.. .. carriage forward, to..Station, in care of.., Forwarding Agents, ...lbs. of Cotton seed.

I agree to furnish you with a full and accurate report, at the end of the season, as to the results of the experiment, on the forms to be supplied by you.

In the case of the experiment being successful, I also agree to ship the whole of my crop of Cotton to the British Cotton Growing Association for sale, and I will allow the aforesaid Association to deduct the cost of the seed from the proceeds thereof.

Date..

Sign here..

Two witnesses. ....
....

Full P.O. Address ....
....

* State whether the seed is to be sent by Passenger or Goods Train or by Parcels Post. (If it is to be sent by Post, 8d. per lb. for postage should be enclosed with the application.)

GOVERNMENT NOTICE No. 242 OF 1906.

Grants-in-Aid of Agricultural Societies and other Similar Organisations.

Notice is hereby given that for the purpose of assisting Agricultural Societies and other organisations formed for the promotion of the agricultural industry, the Government will be prepared to make grants-in-aid to such societies on the following conditions :—

1. Ten shillings for every £ raised by subscriptions, donations, and gate money, the proceeds of which are devoted to the ends specified above. No grants to be made against "value" contributions.

2. Special grants, when funds are available, against the costs actually and *bona-fide* incurred in the future construction of buildings on, or other permanent improvements to, agricultural societies' grounds, provided that such buildings or improvements remain unalienated and vested in the Chairman or Secretary as trustee of the subscribers.

3. The Registrar of Deeds will be notified of all grants made under Clause 2, and will register same against the transfer of the property concerned.

4. The grants will be subject to the approval of the Commissioner of Lands, who will deal with the applications as they are received, fixing a maximum sum to be granted, if he deem necessary, having regard to the funds at his disposal, and the needs of the society concerned.

5. The Commissioner of Lands may alter the conditions under which any grant is made when, in his opinion, it is desirable to do so.

6. Grants will be paid annually on production of a statement of receipts and expenditure signed by the Chairman of the society or club, and bearing a certificate as follows :—

> "I hereby declare the above to be a true and faithful statement of the receipts and expenditure of the................during the period from............to............and that no grant has already been claimed from the Government in respect of any portion of the receipts here shown."

Such declaration to be made before the local Magistrate or Resident Justice of the Peace, and who will also declare as follows :—

> "I certify that to the best of my knowledge and belief the above statement is correct and that the society is entitled to a grant from Government under the conditions laid down in Government Notice No. 242 of 1906"

7. Claims intended for payment before the end of each financial year should be submitted not later than the 30th April.

They must be in respect of subscriptions and donations, etc., received during the twelve months ending on the 31st March of each year, and not prior to the commencement of that period, unless no claim has been made in the previous year.

8. Applications for grants should in all cases be forwarded through the local Resident Magistrate or Resident Justice of the Peace.

9. Copies of the audited balance sheet and the annual report of the society or club should be forwarded to the Department of Agriculture as soon as published.

A. C. MACDONALD,
Acting Director of Agriculture.

Office of the Director of Agriculture,
Pretoria, 5th March, 1906.

* * *

POTCHEFSTROOM EXPERIMENTAL FARM.

SEEDS FOR DISPOSAL.

The following seeds are now available for disposal in limited quantities, price 6d. per lb. f.o.r. Potchefstroom :—

Description.	*Remarks.*
Early Manna	About a month earlier than "Boer" manna. Coarser in stem and not so leafy. Gives large yield of seed.

Description.	*Remarks.*
African Millet	Grows 8 feet high in three months without irrigation. Produces large quantity of fodder.
Jananese Millet	Apparently suits warm localities best.
Sorghum Saccharatum	Recommended for silage purposes. Very nutritious.
Broom-corn (Californian Golden Long Brush)	Useful for making carpet and similar brooms. Well suited to this climate.
Jerusalem Corn, " Brown Dhoura " ..	Resembles Kafir Corn. Grain larger. Heads well developed.

ALEX. HOLM,
General Manager.

STALLION FOR PUBLIC STUD.

	Nos. of Soc.
The Clydesdale Stallion " Tranagric,"	
Sire, Royal Chiet	10,876
1st Dam, Minnie, Vol. XXVIII., by Barons Pride .. .	9,122
2nd Dam, Brenda, 2nd 12,871, by MacGregor . ..	1,487
etc., etc.,	

Will stand at stud at the Experimental Farm, Potchefstroom, at the service fee of £2 2s.

" Transagric " is a black horse, of fully 16 hands, on strong and short limbs, with good feet and pasterns; is full of muscle and quality, and exceedingly well coupled. He is recommended for van or draught purposes.

Arrangements can be made with the General Manager, Experimental Farm, Potchefstroom, for mares to remain at this farm during the service season at reasonable charges for keep and attendance.

ALEX. HOLM,
General Manager.

GENERAL NOTICES.

LIST OF FARMERS' ASSOCIATIONS AND AGRICULTURAL SOCIETIES IN THE TRANSVAAL.

Aapjes River Ward Farmers' Association, Fred. Carlisle, Pyramid Station.
Aapjes River Ward Agricultural Society, A. F. von Gass, Pyramid Station.
Barberton Farmers' Association, C. K. White, Box 87, Barberton.
Barberton Agricultural Society, J. S. Dyce, Barberton.
Bloemhof Agricultural Society, W. L. Dagg, Bloemhof.
Carolina Agricultural Society, J. J. Cardinaal, Box, 83, Carolina.
Christiana Agricultural Society, F. J. Jooste, Box 13, Christiana.
Crocodile River Farmers' Association, F. J. van Deventer, Box 751, Pretoria.
Eastern Transvaal Farmers' Association, T. W. Snaith, Box 75, Springs.
Ermelo Agricultural Society, A. Smuts, Box 5, Ermelo.
Elandsriver Farmers' Association, E. H. Eloff, Rietvlei, Lindley's Poort, Rustenburg.
Haenertsburg Farmers' Association, Haenertsburg, *via* Pietersburg.
Heidelberg Agricultural Society, W. Harvey, Box 36, Heidelberg.
Hekpoort Farmers' Association, Secretary, *via* Krugersdorp.
Hex River Farmers' Association, W. Breedt, Hex River, Rustenburg.
Highveld Farmers' Association, F. Findley, Ceylon, *via* Krugersdorp.
Klerksdorp Agricultural Society, H. Bramley, Box 56, Klerksdorp.
Klipriver Farmers' Association, Krugersdorp.
Koesterfontein Farmers' Association, Secretary, *via* Krugersdorp.
Krugersdorp Farmers' Association, G. Figulus, Box 188, Krugersdorp.
Lydenburg Agricultural Society, S. Hiemstra, Box 69, Lydenburg.
Lydenburg Farmers' Association, E. de Souza, Lydenburg.
Marico Agricultural Society, J. L. van Heerden, Box 82, Zeerust.
Middelburg Agricultural Society, F. Schunke, Box 75, Middelburg.
New Scotland Farmers' Association, H. S. Parry, Grasdal, Lake Chrissie.
New Agatha Farmers' Association, R. F. Shirley, New Agatha, *via* Pietersburg.
Pietersburg Agricultural Society, J. W. Johnson, Box 32, Pietersburg.
Pietersburg Farmers' Association, G. G. Munnik, Pietersburg.
Pietersburg Poultry Club, H. Moore, Box 103, Pietersburg.
Piet Retief Farmers' Association, K. P. van Dijk, Box 18, Piet Retief.
Platrand Farmers' Association, A. H. Barron, Platrand.
Potchefstroom Agricultural Society, J. A. Low, Box 70, Potchefstroom.
Pretoria Agricultural Society, H. Cornforth, Box 685, Pretoria.
Rand Poultry Club, F. H. Stoll, Box 2712, Johannesburg.
Rustenburg Farmers' Association, Leo Machol, Rustenburg.
Southern Waterberg Farmers' Association, C. M. Quarry, P.O., Warmbaths.
Standerton Agricultural Society, F. C. de Witt, Box 158, Standerton.
Spelonken Farmers' Association, J. W. Viljoen, P.O., Spelonken, Zoutpansberg.
Transvaal Agricultural Union, F. T. Nicholson, Box 134, Pretoria.
Transvaal Poultry Club, J. F. Hilson, Box 1129, Pretoria.
Transvaal Stockbreeders' Association, F. T. Nicholson, Box 134, Pretoria.
Vaal River Farmers' Association, J. van Zijl, *via* Potchefstroom.
Waterberg Agricultural Society, E. Tamsen, Nylstroom.
Wakkerstroom Agricultural Society, G. Maasdorp, Volksrust.
Witfontein Farmers' Association, J. Krugel, *via* Krugersdorp.
Witwatersrand Farmers' Association, T. B. Ludorf, Kaalfontein Station.
Witwatersrand Dairy Farmers' Association, H. Clarke, Box 5908, Johannesburg.
White River Farmers' Association, Archibald T. Ralls, White River, *via* Nelspruit.
Wonderfontein Farmers' Association, Secretary, *via* Krugersdorp.
Zwartkop Farmers' Association, M. Vorster, Zwartkop, *via* Krugersdorp.
Zwartruggens Farmers' and Planters' Association, G. R. Wedderburn, J.P., Broadwood Vale, P.O. Kosterfontein, Rustenburg.

Transvaal Land Owners' Association, H. A. Baily, Box 1281, Johannesburg.
Transvaal Consolidated Lands Company, C. A. Madge, Box 4303, Johannesburg.

OTHER COLONIES.

Agricultural Union of Cape Colony, D. M. Brown, Box 187, Port Eliazbeth.
Cape Central Farmers' Association, H. C. Hall, Bedford, Cape Colony.
Cape Colony Stockbreeders' Association, C. G. Lee, Klipplaat Station, Graaf Reinet Line, C.C.
Natal Agricultural Union, D. M. Eadie, Timber Street, Pietermaritzburg.
Orange River Colony Farmers' Association, Stuart L. Mackenzie, Secretary, Bloemfontein.
Orange River Colony Co-operative Union, J. Brink, Secretary, Heilbron, O.R.C.
Orange River Colony Stockbreeders' Association, Secretary, Bloemfontein.
Rhodesian Agricultural Union, Secretary, Box 135, Salisbury, Rhodesia.

* * *

PORTS FOR ENTRY OF STOCK.

The following are the ports for entry of stock into this Colony from the neighbouring Territories:—

Mafeking Road Border	Cape Colony.
Mosimyani	,,
Fourteen Streams	,,
Coal Mine Drift	Orange River Colony.
Vereeniging	,,
Roberts' Drift	,,
Volksrust	Natal.

Komati Poort, through which stock not provided for under Clause 5, Government Notice No. 834 of 1903, will only be allowed to proceed by rail, to be examined at Machadodorp, Portuguese East Africa.

* *

DISEASES OF STOCK.

(Government Notice No. 834 of 1903.)

1. In these Regulations the term "stock" means cattle, sheep, goats, horses, mules, donkeys, and pigs.

2. The following diseases shall be considered contagious diseases for the purpose of these Regulations, and shall be dealt with as hereinafter directed. The list may be added to by Proclamation in the "Gazette":—

(*a*) Rinderpest.
(*b*) Pleuro-pneumonia (or lung-sickness).
(*c*) Redwater and Rhodesian Redwater.
(*d*) Tuberculosis.
(*e*) Foot and Mouth Disease.
(*f*) Anthrax (or splenic fever).
(*g*) Glanders and Farcy.
(*h*) Scab in Sheep and Goats.
(*i*) Swine Fever.
(*j*) Swine Erysipelas.
(*k*) Mange (Scabies) in Horses and Mules.
(*l*) Ulcerative Lymphangitis.
(*m*) Sheep Pox.

* *

AFRICAN COAST FEVER.

Amended Proclamation of the Cape Colony.

By Proclamation No. 231, of July 22nd, 1904, the provisions of Proclamation No. 202, of June 29th, 1904, are amended as follows:—

Dogs and Cats will be admitted with special permission of the Chief Veterinary Surgeon, or his authorised representative, provided they are accompanied by a certificate signed by the Principal Veterinary Surgeon of the Transvaal, or his authorised representative, to the effect that they have not come from or passed through any portion of the Transvaal proclaimed or known to be infected with African Coast Fever.

MADAGASCAR CATTLE.

His Majesty's Consul at Antananarivo has notified His Excellency the High Commissioner that the Export Duty on bullocks from Madagascar has been reduced from twelve shillings to two shillings per head.

* * *

AN ORDINANCE (No. 3 OF 1906) TO IMPOSE A DUTY ON THE EXPORT OF ANGORA RAMS AND EWES.

Be it enacted by the Lieutenant-Governor of The Transvaal with the advice and consent of the Legislative Council thereof as follows:—

1. Upon every Angora ram or ewe exported from this Colony after the date of the taking effect of this Ordinance there shall be payable save as herein provided to the officer appointed to receive the same a duty of one hundred pounds: provided always that no such duty shall be payable on the export of any such ram or ewe to any Colony or Territory in South Africa as soon as the Lieutenant-Governor shall by proclamation declare that such Colony or Territory has by statute provided for the imposition of a duty on the export of Angora rams and ewes not less than the amount imposed by this Ordinance.

2. Every person who shall export from this Colony any Angora ram or ewe (save as in this Ordinance provided) without payment of the duty imposed thereby shall be liable on conviction in addition to the duty to a fine of not less than twenty-five pounds and not exceeding one hundred pounds for every such ram or ewe so exported and in default of payment to imprisonment with or without hard labour for a period of not less than one month and not exceeding six months unless such fine be sooner paid.

3. Courts of Resident Magistrate shall have special jurisdiction to impose any of the penalties provided by this Ordinance for a contravention hereof.

4. It shall be lawful for the Lieutenant-Governor from time to time to make Regulations for carrying out the provisions of this Ordinance.

5. This Ordinance may be cited for all purposes as the Angora Export Duty Ordinance 1906.

Passed in Council the twenty-eighth day of June, One Thousand Nine Hundred and Six.

* * *

DESTRUCTION OF VERMIN.

The following regulation (Section D of Government Notice No 231 of 1906) is published for general information. :—

(D.)—VERMIN.

16. The animals named in Schedule F hereto shall be deemed to be vermin, and rewards for the destruction of them shall be paid at the rates shewn in the Schedule by the Resident Magistrate of the district in which they are destroyed.

17. Vermin may be destroyed by shooting, coursing, by means of nets, springes, gins, traps, snares or by poison, provided that when poison is used for the destruction its use shall be subject to such conditions as the Resident Magistrate of the district may prescribe, and provided that no poison may be used during the open season.

18. In proof of the destruction of vermin the applicant for reward will be required to produce in the case of lion, leopard, cheetah, lynx, serval cat, civet cat, Kaffir cat. genet cat, silver jackal and red jackal, the skin with the tail not severed; and in the case of wild dog, hyena and baboon the head; and will also be required to make a written declaration in the form given in Schedule G hereto.

19. The skins of vermin for the destruction of which reward has been paid shall be the property of the Government, and shall, if in good condition, be marked by the official before whom they are produced at the juncture of the tail with the skin of the body with a perforating stamp, or in such other way as the Colonial Secretary may from time to time prescribe, and thereafter be sold by the Resident Magistrate by public auction or disposed of in such other way as he may consider to be best in the interests of the Government. The proceeds of such sale or disposal shall be paid into Revenue.

Skins not in good condition and heads shall be destroyed.

20. Any person who secures or attempts to secure for himself or any other person a reward for the destruction of vermin by means of a false declaration or by the production of

skins or heads belonging to vermin, for the destruction of which a reward has already been paid, shall be liable on conviction to a fine not exceeding £10 for every head of vermin for which he has secured or attempted to secure such reward.

SCHEDULE F.

	£	s.	d.
Lion	£1	0	0
Leopard	0	10	0
Cheetah	0	10	0
Wild Dog	1	0	0
Hyena	1	0	0
Lynx	0	5	0
Serval Cat	0	5	0
Civet Cat	0	5	0
Kaffir Cat	0	2	6
Genet Cat	0	2	6
Silver Jackal	0	5	0
Red Jackal	0	7	6
Baboon	0	2	6

SCHEDULE G.

I, ...
hereby declare that the following animals -
....
...
....
...
have been destroyed by me within the official boundaries of the..
District, and that the skins and tails (or heads) I have produced to the Resident Magistrate actually belonged to such animals

---

REGULATIONS AND CONDITIONS FOR THE HIRE OF A GOVERNMENT WATER DRILL FOR BORING FOR WATER

1 —SUBMISSION OF APPLICATIONS.

Applications by farmers for the hire of a Government Water Drill for boring for water should be sent on form $\frac{\text{I} \quad \text{D}}{\text{B}}$, No 49 (Revised), to the Boring Engineer, Irrigation Department, P.O Box 557, Pretoria, through the Resident Magistrate of the district in which the applicant resides

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GOVERNMENT NOTICE No. 522 OF 1906.

Under and by virtue of the powers in him vested by Section 4 of the Diseases of Stock Ordinance of 1902, His Excellency the Acting Lieutenant-Governor has been pleased to prohibit, until further notice, the importation of cattle from the Colony of Natal, with the exception of

(1) Stock entering under permit from oversea and passing through Natal by rail;
(2) Slaughter stock travelling direct by rail under permit to any enclosure approved by the Government Veterinary Department for the reception of such slaughter stock.

By Command of His Excellency the Acting Lieutenant-Governor.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 25th May, 1906

GOVERNMENT NOTICE No. 523 OF 1906.

His Excellency the Acting Lieutenant-Governor has been pleased to make the following regulation under Section five of the Diseases of Stock Ordinance of 1902.

Any person who shall import or cause to be imported any stock into this Colony in contravention of the terms of Government Notice No. 522 of 1906, or who shall remove any stock alive from any enclosure therein mentioned, shall be liable upon conviction to a penalty not exceeding Fifty Pounds, and in default of payment of the same to imprisonment with or without hard labour for a period not exceeding six months.

Any cattle introduced without such permit as is mentioned in the said Government Notice may be slaughtered by order of the Commissioner of Lands, or dealt with in whatever manner the Commissioner may prescribe.

By Command of His Excellency the Acting Lieutenant-Governor.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 25th May, 1906.

The following is published for general information.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 31st July, 1906.

It is hereby notified for general information that the undermentioned brands have been duly allotted and registered under the Great Stock Brands Ordinance (Ordinance No. 15 of 1904) during the quarter ending the 30th June, 1906.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture,
Pretoria, 30th July, 1906.

No. of Brand.	Name of Owner.	Address	District.	Brand.
132	Lazarus, Esrael	Van Dyk's Drift, P.O. Vaal Krans	Middelburg ..	G1L
133	Zuurfontein Pound ..	P.O. Zuurfontein	Pretoria ..	◊ A6
134	Prinsloo, Gerhardus Daniel Petrus ..	Wildebeestfontein, P.O. Brugspruit	Middelburg ..	GP1
135	Waterval Boven Pound ..	P.O. Waterval Boven ..	Carolina ..	◊ C2
136	Marais and Krige .. Marais, Pieter Maritz Krige, Berthold St. Jean	135, Skinner St., P.O. Box 151, Pretoria	Pretoria ..	AOK
137	Shaw, Walter and Edgar Charles Albert	Vlakfontein, P.O. Brakkloof	Rustenburg ..	R2E
138	Nell, Sarel Johannes ..	Rietvlei 126/133, P.O. Eikenhof	Witwatersrand	XN3
139	Wolmarans, John Barend	80, Proes St., Box 866, Pretoria	Pretoria ..	A1W
140	Bannink, Barend Johannes	Brakfontein, P.O. Nylstroom	Waterberg ..	W2B
141	James, Richard Thomas Nicholas	Jamesville, Silverton, P.O. Private Bag, Koedoespoort	Pretoria ..	AX1
142	Adamji, Abramji (Indian)	Coolie Location, Box 1090, Pretoria	Pretoria ..	AA2
143	MacKinnon, Neil	Glenavon, P.O. Roodepoort Station	Witwatersrand	XM4
144	Trollope & Sons .. .. Trollope, Samuel Wesley, „ Wesley Booth, & „ Stephen Harold	Hartebeesthoek 524, P.O. Box, 355, Pretoria	Pretoria ..	AOT
145	Gerstle, Hermann ..	Biesjesvlei	Lichtenburg ..	LG2
146	Corbett, John Houghton	Klerksdorp	Lichtenburg ..	LC7
147	Foulis, Charles James Liston	Turflaagte, Lichtenburg ..	Lichtenburg ..	LF1
148	Heald, James	P.O. Box 93, Standerton ..	Standerton ..	SHO
149	Elder, William	Kaffir Kraal Koppies 154, P.O. Box 46, Standerton	Standerton ..	SOE
150	Jacobs Gabriel Gerhardus	Drinkwater 43, P.O. Kaffirspruit	Ermelo ..	EOJ
151	Collins, William Richard..	Erf 507, Box 41, Ermelo ..	Ermelo ..	EIC
152	Quinlan, Cornelius ..	P.O. Lydenburg	Lydenburg ..	YQ1
153	Ehlers, George Antoonie ..	Nooitgedacht, P.O. Hekpoort	Krugersdorp ..	KE1
154	Wit, de, Jan David ..	Doornbosch, P.O. Hekpoort	Krugersdorp ..	KW1

No. of Brand.	Name of Owner.	Address.	District.	Brand.
155	Cronje, Cornelius Johannes Andries	P.O. Hekpoort	Krugersdorp ..	KC1
156	Lucas, Alexander Bisset ..	P.O. Box 7, Florida ..	Krugersdorp ..	KL1
157	Grobler, Pieter Willem Johannes Nicholas	Hartebeestfontein, P.O. Hekpoort	Krugersdorp ..	KG2
158	Smook, Jan Josephus Joachim	Hamburg, P.O. Hamburg ..	Krugersdorp ..	KS4
159	Lee, Johannes Lodewicus..	Waterkloof, P.O. Zandriverspoort	Waterberg ..	WL1
160	Vuuren, van, Cornelis ..	Oranjefontein, P.O. Zandriverspoort	Waterberg · ..	WV4
161	Heerden, van, Stephanus Johannes Martinus	Klipdrift 1813, P.O. Zwagershoek	Waterberg ..	W2S
162	Whitcher, Percy	Springbokflats, Warmbaths	Waterberg ..	WW1
163	Eloff, Hendrik Johannes Swanepoel	Rhenosterfontein 544, P.O. Zwagershoek	Waterberg ..	W2H
164	Heerden, van, George Frederick Stephanus	Klipdrift 1813, P.O. Zwagershoek	Waterberg ..	W3F
165	Neuhoff, George Ernest ..	New Modderfontein, P.O. Benoni	Witwatersrand	XN5
166	Papenfus, Herbert Boshof	Beanlien, Box 5155, Johannesburg	Pretoria ..	APO
167	Adendorff (Jr.), Michael Joseph	Wonderboom, Box 1042, Pretoria	Pretoria ..	AHO
168	Pilkington, William Henry	Baviaanskrans 90, P.O. Leeuwdoorns	Wolmaransstad	V1P
169	Boonstra, Gerrit	P.O. Box 15, Volksrust ..	Wakkerstroom	UB7
170	MacDonald, Alister Archie	Greenhill, P.O. Volksrust ..	Wakkerstroom	UA4
171	Clarke, William	Dalhousie Park, Portion Vlakfontein	Bethal ..	TXO
172	Villiers, de, Jacob Rudolph	Vogelstruisfontein 55, P.O. Roodepoort	Krugersdorp ..	KV2
173	Diack, George Albertus ..	P O. Roodepoort	Krugersdorp ..	KG1
174	Heyneke, Johannes Jochimus	Muiskraal, P.O. Fredrikstad	Potchefstroom	PJ2
175	Venter, van de, Pieter Gabriel	Gerhardminnebron, P.O. Fredrikstad	Potchefstroom	PV2
176	Lemmer, Adriaan Isaac ..	P.O. Hartebeestfontein (624)	Potchefstroom	PL8
177	Vermaas, Frans Hermanus Stefanus	Gedult 158, P.O. Hartebeestfontein	Potchefstroom	PV7
178	Bantjes, Jan Gerritze ..	Bovenste Oog van Mooi River, P O. Klerkskraal	Potchefstroom	PB3
179	Nysschen, Albertus Petrus	Gedult, P.O. Hartebeestfontein	Potchefstroom	P2N
180	Nysschen, Andries Martinus	Gedult, P.O. Hartebeestfontein	Potchefstroom	PN2
181	Botha, Petrus Johannes ..	Modderfontein, P.O. Klerksdorp	Potchefstroom	PB1
182	Lelyveld, van, Phillip ..	Elandsheuvel, P.O. Klerksdorp	Potchefstroom	PL3
183	Lombard, Johannes Frederick	Hartebeestfontein P.O. (624)	Potchefstroom	P1F
184	Weeber, Cornelis Andries..	Wolvepan, Box 4, Ventersdorp	Potchefstroom	PA7
185	Cheyne, Andrew	Bultfontein, P.O. Ventersdorp	Potchefstroom	PC2
186	Cronje, Pieter Arnoldus ..	Palmietfontein P.O. ..	Potchefstroom	PC1
187	Jooste, Pieter Jacobus ..	P.O. Hartebeestfontein ..	Potchefstroom	PJ1
188	Eeden, van, Gideon Willem	P.O. Hartebeetfontein ..	Potcheftroom	PE5
189	Heerden, van, Petrus Johannes	P.O. Hartebeestfontein ..	Potchefstroom	PH5
190	Lombard, Paul Michiel ..	P.O. Hartebeestfontein ..	Potchefstroom	P2L
191	Lemmer, Richard Hermanus	P.O. Hartebeestfontein ..	Potchefstroom	P7R
192	Lemmer, Hermanus Richard	P.O. Hartebeestfontein, Oorbietjesfontein	Potchefstroom	PH1

No. of Brand.	Name of Owner.	Address	District.	Brand.
193	Ratsey, Joseph Frederick	Klerksdrift East, P.O. Klerksdorp	Potchefstroom	PF1
194	Bouwer, Antonie Michiel..	Zwartkoppies, P.O. Klerksdorp	Potchefstroom	PB2
195	Gouws, Willem Andries Stephanus	Boschhoek 159, P.O. Fredrikstad	Potchefstroom	PG2
196	Coetze, Thomas Frederick	Varkenskraal, P.O. Klerkskraal	Potchefstroom	PT4
197	Preez, du, Jacobus Pieter	Varkenskraal, P.O. Klerkskraal	Potchefstroom	PJ3
198	Preez, du, Louis Jacobus Pieter	Varkenskraal, P.O. Klerkskraal	Potchefstroom	PP2
199	Coertze, Andries Cornelis Frederick	P.O. Klerkskraal	Potchefstroom	PA1
200	Zyl, van, Gideon	Bovenste Oog Mooi River, P.O. Klerkskraal	Potchefstroom	PG1
201	Le Roux, Phillipus Jacobus Le Roux, Pieter Johannes Stephanus Zyl, van, Isaac Daniel ..	Bovenste Oog Mooi River, P.O Klerkskraal	Potchefstroom	PX1
202	Wilson, Richard Currie ..	Rooipoort, P.O. Ventersdorp	Potchefstroom	PC3
203	Hudson, Charles William..	P.O. Ventersdorp . ..	Potchefstroom	PH3
204	Pieterse, Hendrik Nicholaas	Sterkstroom, P.O. Ventersdorp	Potchefstroom	PH2
205	Vosloo, Matthys Johannes	Sterkstroom, P O. Palmietfontein	Potchefstroom	PV4
206	Eeden, van, Jacobus Adriaan	P O Hartebeestfontein ..	Potchefstroom	PV3
207	Roetz, Johannes Michiel ..	Witkop, P O Lindeques Drift	Potchefstroom	PR5
208	Badenhorst, Lourens ..	Rietfontein, Box 166, Potchefstroom	Potchefstroom	PL7
209	Ackerman, Gert Johannes	Oorbietjesfontein, P O. Lindeques Drift	Potchefstroom	PA2
210	Kruger, Daniel Frederick	Rietfontein 555, P.O. Potchefstroom	Potchefstroom	PK7
211	Blignaut, Stefanus Johannes	Kaalplaats, P O Vereeniging	Potchefstroom	PS6
212	Geldenhuis, Nicolaas Petrus	Holfontein, P O. Lindeques Drift	Potchefstroom	PP1
213	Zyl, van, Jan Jacobus ..	Zeekoefontein, P O Lindeques Drift	Potchefstroom	PZ1
214	Zyl, van, Jan Jacobus Hendrik	Holfontein, P O Lindeques Drift	Potchefstroom	PJ4
215	Plessis, du, Johannes Jurgens	Zeekoefontein, P O Lindeques Drift	Potchefstroom	PJ5
216	Art, Thomas	Vereeniging Estates, P O. Vereeniging	Potchefstroom	PA3
217	Hammond, Harold Aubrey	Mooibank, Box 168, Potchefstroom	Potchefstroom	P0H
218	Jaffray, John	Mooibank, P O Mooibank .	Potchefstroom	P0L
219	Lawrence Awbrey, Henry	P.O. Mooibank . ..	Potchefstroom	P8L
220	Lindeque Drift Pound ..	P.O. Lindeque Drift ..	Potchefstroom	◊ P7
221	Wyk, van, Laurens Dirk Cornelis	Rietfontein, P O. Van Wyk's Rust	Krugersdorp .	KV7
222	Lange, de, Barend Jacobus	Olivantsvlei, P O. Van Wyk's Rust	Krugersdorp ..	KL2
223	Watts, Arend Josias ..	Misgund, P.O Eikenhoff ..	Krugersdorp	KW4
224	Meeding, Rulof Pieter ..	Misgund, P O. Eikenhoff ..	Krugersdorp ..	KM2
225	Strydom, Daniel Jacobus..	Misgund, P.O Eikenhoff ..	Krugersdorp ..	K18
226	Kotze, Paul	Vlakfontein 50, Van Wyks Rust	Krugersdorp ..	KP7
227	Carbonatte, Guiseppe ..	Zand Braband 1663, P O Box 145, Pretoria	Waterberg .	W1G

No. of Brand.	Name of Owner.	Address.	District.	Brand.
228	Garlick and Holdcroft ..	Market St., Box 101, Johannesburg	Witwatersrand	XG1
229	Mansell, William John ..	P.O. Ermelo	Ermelo ..	EM1
230	Long, Ernest George ..	Mooifontein, P.O. Maritzani Siding, near Mafeking	Lichtenburg ..	L1L
231	Swanepoel, Hendrik Johannes	Welgevonden, P.O. Zwagershoek	Waterberg ..	W6S
232	Swanepoel, Gerhardus Johannes	Welgevonden, P.O. Zwagershoek	Waterberg ..	W8G
233	Eaton, John Kier ..	Box 15, Krugersdorp ..	Krugersdorp ..	K1E
234	Oldknow, Harry Walter ..	Box 26, Volksrust	Wakkerstroom	US0
235	Kennersley, Oriel Dean ..	Blaauwboschkuil, P.O. Kingswood	Wolmaransstad	VK0
236	Stolp, John	Welgelegen, Box 42, Ermelo	Ermelo ..	EL7
237	Erasmus, Johannes Jurie	P.O. Hekpoort	Krugersdorp ..	KE2
238	Krige, Johannes	Doornkloof, P.O. van der Merwe Station	Pretoria ..	A1K
239	Freedman, Isaac, and Joffe, Benjamin ..	Box 171, Krugersdorp ..	Krugersdorp ..	KF1
240	Amm, Richard Gush ..	Rietfontein 503, Box 22, Potchefstroom	Potchefstroom	PA0
241	Amm, Mary Ann Louisa..	Rietfontein 503, Box 22, Potchefstroom	Potchefstroom	P1A
242	Amm, Reuben George ..	Rietfontein 503, Box 22, Potchefstroom	Potchefstroom	P9A
243	Goodliff, George	P.O. Mooibank	Potchefstroom	P1G
244	Erasmus, Kelly	Roodepoortje 250, P.O. Balmoral	Middelburg ..	GK3
245	Mallandain, William Arthur John	Van Kolders Kop, Heidelberg, Box 450, Johannesburg	Heidelberg ..	H0T
246	Mallandain, Charles Henry	Vogelstruisbult, Heidelberg, Box 66, Springs	Heidelberg ..	H3M
247	Brink, Andries Jacob ..	Boschfontein, P.O. Heidelberg	Heidelberg ..	HA7
248	Botha, Frederick Andries..	Rietspruit 105, P.O. Heidelberg	Heidelberg ..	H7B
249	Alberts (Jr.), Hendrik Abraham	Boschfontein, Box 27, Heidelberg	Heidelberg ..	H2A
250	Kotze, Gerhardus ..	Box 71, Heidelberg	Heidelberg ..	H1K
251	Moller, Ernest Lodewyk..	Rietkuil, P.O. Lichtenburg	Lichtenburg ..	L3M
252	Symonds, George	Mooibank Settlement, P.O. Mooibank	Potchefstroom	P0G
253	Pile, James*	Mooibank Settlement, P.O. Mooibank	Potchefstroom	P1L

Brands Transferred in Terms of Section 12 of the Great Stock Brands Ordinance, 1904.

No. of Brand.	Transferred from.	Transferred to	District.	Brand.
44	Hargrove and Johnson, Rietgat, Lichtenburg	Hargrove, William Thomas Aulton, Rietgat, Lichtenburg	Lichtenburg ..	LH1
541	Cassidy, Harry Ewert, of Nylstroom	Hilliard, Arthur Herbert, of Nylstroom	Waterberg ..	W1X

RAINFALL RETURNS FOR THE MONTHS OF MAY, JUNE, JULY AND AUGUST, 1906.

NOTE.—The rainy season is measured from 1st July in one year to the 30th June in the next.

MAY, 1906.

District.	Place.	May. Ins.	May. Days.
Barberton	Barberton	Nil.	0
	Komati Poort	0·93	2
Bethal	Bethal	0·21	2
Bloemhof	Christiana	0·26	3
	Schweizer Reneke	0·02	1
Carolina	Carolina	Nil.	0
Ermelo	Ermelo	0·02	1
Heidelberg	Vereeniging	0·17	2
	Withoek	0·30	1
	Heidelberg	0·19	2
	Balfour	0·16	2
Lichtenburg	Barberspan	Nil.	0
	Lichtenburg	0·02	1
Lydenburg	Belfast	0·03	3
	Lydenburg	Nil.	0
	Pilgrims Rest	0·24	12
	Sabie	0·32	4
Marico	Ottoshoop	0·02	1
	Zeerust	0·01	1
Middelburg	Middelburg	0·06	3
	Pan	Nil.	0
Piet Retief	Bergplaats	0 36	3
Potchefstroom	Klerksdorp	0·06	1
	Ventersdorp	0·02	1
	Potchefstroom	0·04	2
	Driefontein	Nil.	0
Pretoria	Government Buildings, Pretoria	0·08	2
	Arcadia, Pretoria	0 10	2
	Premier Diamond Mine	Nil.	0
	Irene	0 08	1
Rustenburg	Rustenburg	0·01	1
	Naauwpoort	Nil	0
	Zoutpansdrift	0·01	1
Standerton	Standerton	0·41	2
	Val	0·38	2
	Earleridge	0·46	2
	Paardekop	0·76	3
Swaziland	Mbabane	0·62	5
	Hlatikulu	0·43	6
Wakkerstroom	Volksrust	0·61	2
	Rolfontein	Nil.	0
	Wakkerstroom	0·27	2
Waterberg	Warmbaths	Nil.	0
	Nylstroom	0·12	1
	Experimental Farm, Ludlow ..	Nil.	0
	Potgietersrust	0·02	1
Witwatersrand	Krugersdorp	0·08	3
	Langlaagte	0·29	1
	Johannesburg	0·16	2
	Joubert Park	0·13	2
	Government Observatory ..	0·11	2
	Belgravia	0·15	3
	Germiston	0·09	2
	Boksburg	Nil.	0

District.	Place.	May. Ins.	Days.
Wolmaransstad	Uitkyk	Nil.	0
	Wolmaransstad	0·07	2
	Matjesspruit	0·14	2
Zoutpansberg	Pietersburg Hospital	0·5	1
	Woodbush Forest	0·16	1
	Louis Trichardt	0·61	2
	Krabbefontein	0·02	1
	New Agatha	0·06	3
	Sibasa	0·10	1
	Tsemavunga Poort	0·01	1
	Free State Camp	Nil.	0
	Haenertsburg	Nil.	0

JUNE, 1906.

A detailed return is not made out for this month, as there was no rainfall with the exceptions of:—

District.	Place.	June. Ins.	Days.
Bloemhof	.. ..	0·05	2
Potchefstroom	Klerksdorp	0·02	1
	Elandsheuvel	0·04	1
	Potchefstroom	0·02	2
Swaziland	.. ..	0·07	2
Zoutpansberg	Diana	0·08	1
	Moddervlei	0·08	1
	Middelrand	0·06	3

Drops of rain were also recorded at a few other stations.

Lichtenburg, Lydenburg, Middelburg, and Wolmaransstad Districts.—Drops of rain were recorded at one or two stations in each of these districts.

JULY, 1906.

With the following exceptions, no rainfall has been reported during this month:—

District.	Place.	July. Ins.	Days.
Lydenburg	Pilgrims Rest	0·07	1
Rustenburg	Rustenburg	0·01	1
Swaziland	Mbabane	0·04	2
Zoutpansberg	Louis Trichardt	0·11	1

AUGUST, 1906.

With the exception of two showers yielding less than half-an-inch in Swaziland and much less in portions of the Zoutpansberg, no rain fell in August. Some misty dews were experienced on the eastern side of the Drakensberg (Mbabane, Pilgrims Rest, Bushbuck Ridge). This record is quite similar to that for the corresponding month last year. The average rainfall in the Transvaal during August is about one-third of an inch.

PRETORIA AND JOHANNESBURG PRODUCE MARKET PRICES.

(Supplied by the Commercial Agency Co., Limited, Seed and Produce Merchants, No. 116, Vermeulen Street; Telephone No. 165; Box 784, Pretoria. and by Messrs. Hubert Morisse & Co., Produce Merchants and Commission Agents, Loveday and Frederick Streets, Box 68, Johannesburg.)

PRETORIA.

Description	*July*, 1906		*August*, 1906.	
	Lowest.	Highest	Lowest	Highest
	£ s d	£ s d	£ s d.	£ s d
Forage, per 100 bdls ...	0 17 6	1 6 0	0 13 0	1 5 0
White mealies, per bag ...	0 11 3	0 12 3	0 12 6	0 13 6
Yellow mealies, per bag ..	0 11 6	0 12 9	0 13 0	0 14 6
Kaffir corn, per bag	0 10 0	0 12 6	0 12 6	0 13 6
Wheat, per bag	1 2 6	1 5 0	1 5 6	1 10 6
Bran ...	0 10 0	0 11 0	0 9 9	0 10 6
Oats... ..	0 15 9	0 17 6	—	—
Chaff	0 7 6	0 10 6	0 7 6	0 8 6
Hay	0 1 1	0 1 6	0 0 6	0 1 3
Bedding, per bale ..	0 0 6	0 0 10	0 0 6	0 0 9
Green barley	0 2 0	0 3 6	0 1 0	0
Potatoes, per bag .	0 17 6	1 2 0	0 15 0	1 0 6
Onions, per bag ...	0 12 6	0 14 0	0 13 0	0 16 6
Eggs, per doz	0 1 9	0 2 6	0 1 2	0 2 3
Fowls, each ...	0 2 1	0 3 6	0 1 6	0 2 10
Ducks, each ...	0 2 8	0 3 6	0 3 0	0 3 6
Turkeys, each .	0 9 0	0 15 6	0 8 0	0 14 0
Tobacco, cut, per lb.	0 0 2	0 0 4	0 0 1½	0 0 3
Tobacco, per roll ...	0 0 4	0 1 0	0 0 2	0 2 6
Oranges, per 100 ..	0 4 0	0 7 6	0 2 0	0 6 6
Naartjes, per 100 ...	0 2 0	0 6 3	0 1 6	0 8 3
Lemons, per 100	0 1 6	0 4 0	0 2 6	0 5 0
Manna, per 100 lbs. ...	0 10 0	0 12 6	0 7 6	0 10 0
Pigs, each ...	0 15 0	3 2 6	0 17 0	2 5 0
Firewood, per load	1 2 6	4 15 0	0 12 0	3 12 6

JOHANNESBURG.

Description	July, 1906.						August, 1906					
	Lowest.			Highest.			Lowest.			Highest.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Forage, per 100 lbs	0	5	0	0	8	6	0	5	0	0	8	0
Mealies, per bag ...	0	10	9	0	12	0	0	12	0	0	13	0
Kaffir corn, per bag ...	0	10	9	0	12	0	0	13	9	0	14	9
Barley, per 163 lbs ...	0	7	9	0	10	6	0	11	6	0	12	0
Oats, per 133 lbs. ...	0	11	9	0	12	6	0	12	9	0	13	9
Wheat, per 203 lb	0	19	6	1	0	6	1	0	6	1	1	6
Bran, per 100 lb	0	9	0	0	9	3	0	8	0	0	8	9
Green lucerne, per 100 lb ...	0	6	9	0	7	3	0	7	0	0	7	3
Sweet grass, per bale ...	0	1	6	0	2	6	0	1	9	0	2	6
Bedding, per bale	0	0	6	0	1	0	0	0	6	0	1	0
Chaff, per 100 lb	0	3	0	0	5	6	0	3	0	0	4	6
Potatoes, per bag	0	7	0	0	15	6	0	10	0	0	18	0
Onions, per bag of 125 lb	0	10	6	0	11	6	0	11	6	0	13	0
Eggs, per doz.	0	1	3	0	1	5	0	1	11	0	2	2
Fowls	0	1	9	0	3	0	0	2	0	0	3	3
Ducks	0	2	6	0	3	0	0	3	0	0	3	6
Turkeys	0	4	6	0	10	6	0	4	6	0	10	6
Geese	0	5	9	0	7	0	0	5	9	0	7	0
Pigs, per lb.	0	0	3¾	0	0	4	0	0	3	0	0	3½
Hay, per 75 lb. .. .	0	0	8	0	0	9	0	0	9	0	1	3
Salt, per bag	0	6	3	0	6	9	0	6	3	0	6	6
Butter, O.R.C., per lb ...	0	0	9	0	1	3	0	0	9	0	1	3
Pumpkins, per 100 lb ...	0	2	0	0	2	6	0	2	0	0	2	6
Rye	1	1	6	1	2	0	1	1	6	1	2	0

STATEMENT OF QUANTITY AND VALUE OF GOODS RELATING IN ANY WAY TO AGRICULTURE, IMPORTED INTO THE TRANSVAAL DURING THE YEAR ENDED 30TH JUNE, 1906, COMPARED WITH THE YEAR ENDED 30TH JUNE, 1905.

(Compiled from Statistics published in *The Transvaal Government Gazette*, and from Returns furnished by the South African Customs Statistical Bureau, Capetown.)

ARTICLES.	1905. Quantity.	1905. Value.	1906. Quantity.	1906. Value.
		£		£
Animals, Living—				
Cattle ....No.	10,686	131,615	17,589	215,556
Donkeys ....No.	—	—	560	5,181
Horses ....No.	6,447	165,925	4,762	175,166
Goats ....No.	—	—	9,229	7,599
Mules ....No.	1,426	19,515	3,716	54,880
Pigs ....No.	7,027	10,925	5,234	10,111
Poultry ....No.	397,292	62,521	—	25,240
Sheep and Lambs ....No.	194,383	233,845	226,584	270,733
All others.....................No	5,665	4,980	—	60,619
Antifriction Grease	—	—	—	19,383
Cotton Manufactures—				
Piece Goods ....lbs.				239,083
Blankets, Sheets and Rugs .....lbs		292,013		
Shawls ....lbs.				219,234
All others, except Hosiery ....lbs				
Feathers—				
Ostrich ....lbs.	—	—	—	5,318
All others ....lbs.	—	—	—	1,574
Fodder and Forage—				
Hay of all kinds ....lbs.			41987,925	77,244
Lucerne........................lbs.	79,623,227	175,551	7,976,870	18,379
All other ....lbs.			23,547,669	49,606
Food and Drink, articles of —				
Ale, Beer and Stout ....galls.	441,167	62,279	372,317	54,431
Bacon and Hams ....lbs.	—	—	30,58,768	98,135
Barley, Pearl ....lbs	—	—	345,160	1,972
Biscuits ....lbs.	—	58,655	2,071,684	54,466
Butter—				
Butter ....lbs.	4,468,271	196,312	4,463,837	211,872
Ghee ....lbs.	678,255	16,744	1,114,053	27,045
Margarine and other substitutes lbs.				
Cakes ....lbs.	—	—	466,248	13,992
Cheese ....lbs.	1,983,567	51,539	1,782,404	47,204
Chicory ....lbs.	324,830	3,309	340,905	3,195
Chocolate and Cocoa (unsweetened)lbs.	128,370	14,022	141,954	15,669
Cider ....galls.	—	—	2,761	569
Cocoa (or Coffee) and Milk ......lbs.	—	—	1,363	96
Coffee—				
Raw ....lbs.	3,888,483	65,463	4,277,162	79,222
Roasted, Ground or Mixed .....lbs.	709,092	27,605	485,420	20,749
Confectionery, etc.—				
Confectionery of all sorts ......lbs.	2,176,843	70,285	2,376,111	78,263
Ginger (preserved) & Chow Chow lbs.	—	—	31,451	654
Honey ....lbs.	49,739	1,105	38,723	1,014
Jams and Jellies ....lbs.	2,158,409	36,234	2,686,764	47,591

STATEMENT OF QUANTITY AND VALUE OF GOODS IMPORTED, ETC.—(*Contd.*)

Articles.	1905.		1906.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Corn, Grain and Flour—				
Barley ....lbs.	927,579	5,017	306,596	1,349
Beans and Peas ....lbs.	4,421,947	18,592	2,947,976	15,019
Kaffir Corn ....lbs.	5,697,807	17,464	3,970,637	10,167
Maize ....lbs.	88,645,632	194,324	56,566,987	141,300
Malt ....lbs.	9,459,866	56,631	10,039,304	62,955
Oats ....lbs.	30,483,895	77,751	18,909,778	60,383
Samp ....lbs.	—	—	37,388	131
Wheat ....lbs.	2,428,731	11,152	2,722,397	10,967
Flour (or Meal), Wheaten ..... lbs.	89,169,764	432,306	96,780,539	449,560
Maize Meal ....lbs.	7,498,945	24,335	9,152,010	23,329
Bran ....lbs.	1,745,445	47,113	22,334,959	53,590
Other kinds ....lbs.	Included in	Maize Meal (1905)	1,555,582	8,244
Curry Powder ....lbs.	—	—	39,477	1,139
Dripping or Fat (for food) ....lbs.	—	—	26,279	704
Eggs ....No.	2,166,936	116,283	—	124,464
Fruit—				
Fresh	—	144,045	—	153,345
Bottled or Tinned ....lbs.	857,656	15,643	1,284,607	22,125
Almonds and Nuts of all sorts ...lbs.	—	—	—	9,775
Dates ....lbs.				
Dried Fruits ....lbs.	2,091,580	31,071	1,850,730	27,182
All others ....lbs.				
Lard ....lbs.	—	—	1,031,652	18,998
Meats—				
Beef, fresh or frozen...........lbs.	Including	Game	51,840,075	486,004
Mutton do. ....lbs	62,473,722	794,229	16,874,591	184,700
Pork do. ....lbs.			1,232,533	23,646
Poultry & Game, fresh or frozen..lbs.	—	—	2,109,834	58,623
Meats, salted or cured, except bacon and ham, not tinned ......lbs.	Preserved, including bacon and ham (1905) 6,479,517	186,984	69,756	1,888
Meats, tinned or similarly preserved lbs.	—	—	2,587,531	80,918
Milk or Cream	10,417,670	178,432	11,821,929	193,910
Mustard ....lbs.	—	—	86,531	3,980
Oatmeal	—	—	1,766,864	14,973
Oil, Salad or Olive ....galls.	—	—	—	6,287
Pickles and Sauces...............lbs.	1,153,544	34,030	962,679	22,707
Rice ....lbs.	24,934,792	81,369	26,176,024	89,738
Salt, common or table .... lbs.	12,129,292	14,062	13,670,811	14,292
Spirits (potable)—				
Brandy South ....galls.			18,356	3,959
Gin African ....galls.	19,715	4,392		
Rum Produce ....galls.			102	3
Whisky ....galls.				
Brandy ....galls.			69,678	52,933
Gin ....galls.	597,873	245,276	129,085	15,309
Rum ....galls.			18,431	8,180
Whisky ....galls.			380,629	176,566
Liqueurs and sweetened spirits..galls. (*Vide* also spirits, non-potable).	8,528	4,883	9,611	5,200

Statement of Quantity and Value of Goods Imported, etc.—(*Contd.*)

Articles.	1905.		1906.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Sugar— lbs.	40,248,143	368,348	—	—
Raw or unrefined .... lbs.	—	—	39,235,150	308,758
Refined and Candy .... lbs.	—	—	4,726,777	39,234
Glucose .... lbs.	—	—	—	—
Golden Syrup .... lbs.				
Molasses and Treacle .... lbs.	—	—	3,055,608	27,397
Saccharum .... lbs.				
Tea	1,920,702	89,560	2,289,908	108,451
Vegetables—				
Onions.. .... lbs.	4,957,401	20,537	5,955,773	23,265
Vegetables—(*continued*)				
Potatoes .... lbs.	14,616,797	49,897	16,702,559	59,662
Potatoes (for seed) .... lbs.	—	—	389,352	595
All other fresh vegetables....... lbs.	—	20,090	—	28,405
Tinned or otherwise prepared .. lbs.	2,193,818	24,401	2,500,513	30,906
Wine—				
Not exceeding 20 per cent.				
In wood .... galls.			19,874	3,702
In bottle, Still .... galls.			40,800	11,855
Exceeding 20 per cent.	84,022	32,856		
In Wood .... galls			37,617	7,142
In Bottle, Still .... galls.			43,212	21,157
Sparkling.................... galls	16,424	27,648	17,201	29,279
Wine (S.A.P.) of all kinds ...... galls.	123,431	26,440	78,978	13,892
All other articles of food and drink (N.O.D.)	—	—	—	54,225
Hides and Skins—				
Hides, cattle	—	—	—	622
Skins, Sheep and Goat .... lbs.	—	—	—	1,863
All other Hides and Skins...... lbs.	—	—	—	1,722
Hops .... cwt	—	25,994	—	11,195
Implements—				
Agricultural	—	48,093	—	44,268
Kaffir Hoes and picks	—	2,607	—	2,431
India-rubber and Gutta-percha—				
Raw............................	—	—	—	67
Manufactures of	—	—	—	12,338
Jute Goods, including Hessian	—	—	—	2,636
Leather Goods—				
Boots and Shoes	—	415,654	—	453,621
Saddlery and Harness	—	41,207	—	41,661
Manufactures of leather (N.O.D.)...	—	29,142	—	35,651
Unmanufactured leather	—	23,136	—	24,308
Machinery—				
Agricultural	—	68,507	—	13,223
Manures and Fertilizors .... lbs.	—	—	—	2,677
Oils—				
Castor .... galls.	6,839	1,277	18,048	3,080
Lard .... galls.	6,571	946	4,591	621
Linseed .... galls.	80,350	7,037	151,322	10,131
Seeds—				
Bird seed, including canary..... lbs.				
Garden and Vegetable (except Potato) .... lbs.	Trees and plants (1905.)	43,272	—	14,849
All other (N.O.D.) .... lbs.				
Sheep Dip		3,355	—	5,127

STATEMENT OF QUANTITY AND VALUE OF GOODS IMPORTED, ETC.—(*Contd.*)

Articles.	1905. Quantity.	1905. Value.	1906. Quantity.	1906. Value.
Silk Manufactures—				
Piece Goods	—	—	—	22,828
Made up Articles (N.O.D.)				
Soap—				
Common ....lbs.	8,143,138	83,707	7,495,803	83,979
Toilet and Extracts ....lbs.	167,565	7,863	—	14,716
Tallow and Grease ....lbs.	—	14,803	—	3,923
Tar and kindred substances—				
Asphalte and Bitumen ....lbs.	—	—	—	11,057
Tar Pitch, etc. ....lbs.				
Tobacco—				
Unmanufactured and				
unstemmed ....lbs.				
stemmed ....lbs.	1,469,186	33,820	1,087,427	21,764
Cigars ....No.	11,477,250	61,706	lbs. 164,343	62,258
Cigarettes ....No.	119,787,850	84,972	lbs. 328,306	95,170
Manufactured and cut . ....lbs.				
Manufactured, but uncut .. ...lbs.	520,950	40,112	804,872	70,412
Manufactured (N.O.D.), including				
snuff .... .lbs.				
Tobacconists' Wares—				
Pipes of all sorts	—	—	—	16,983
All other (N.O.D.)	—	—	—	6,776
Vehicles—				
Carts and carriages (not motor) ..	—	161,981	—	102,149
Wax—				
Paraffin and stearine .. . . .lbs	—	—	1,013,578	12,073
Wood and Timber—				
Teak	—	364,435	—	4,827
Unmanufactured, other than teak .				240,969
Planed and grooved	—	—	—	74,427
Manufactured, other than furniture .	—	169,173	—	144,066
Wool, Sheep's .. . .lbs.	—	—	69,972	1,705
Woollen Manufactures—				
Blankets and Rugs				67,496
Cloth and Piece Goods	—	131,746	—	59,586
Shawls.........				14,133
All other (except Hosiery)				12,030

STATEMENT OF QUANTITY AND VALUE OF GOODS RELATING IN ANY WAY TO AGRICULTURE, EXPORTED FROM THE TRANSVAAL DURING THE YEAR ENDED 30TH JUNE, 1906, COMPARED WITH THE YEAR ENDED 30TH JUNE, 1905.

(Compiled from Statistics published in *The Transvaal Government Gazette*, and from Returns furnished by the South African Customs Statistical Bureau, Capetown.)

Articles.	1905. Quantity.	1905. Value.	1906. Quantity.	1906. Value.
		£		£
Animals, Living				
Donkeys and Mules .... No.	—	—	2,593	48,840
Goats .... No.	—	—	134	98
Horses .... No.	and Mules (1905). 10,810	284,595	1,543	96,954
Pigs .... No.	—	—	25	18
Poultry .... No.	—	—	—	639
Sheep, and Lambs .... No.	and Goats (1905). 14	59	530	897
All other .... No.	25,949	362	—	3,416
Asbestos .... lbs.	—	—	12,998	90
Candles .... lbs.	—	—	4,357	72
Cotton Manufactures—				
Piece Goods	—	—	—	5,175
Blankets, Rugs and Sheets .... Hosiery, etc. .... All other	—	—	—	3,719
Curiosities, etc				
Karosses .... Specimens of Nat. History .... All other	—	—	—	6,101
Feathers—				
Ostrich .... lbs.	—	—	—	1,563
All other	—	—	—	32
Flowers and Grasses (Dried) .... lbs.	—	—	—	13
Fodder and Forage—				
Hay .... lbs.	1,248,094	1,740	34,942	122
All other .... lbs.			63,088	163
Ale, Beer, Stout and Cider .... galls.	—	—	62,786	9,608
Biscuits, Bread, Cakes .... lbs.	—	—	—	311
Butter—				
Butter .... lbs.	—	—	44,533	1,873
Ghee .... lbs. Margarine and other substitutes. lbs.	—	—	3,497	130
Cheese .... lbs.	—	—	5,130	172
Chicory .... lbs.	—	—	1,601	18
Cocoa and Chocolate (unsweetened) lbs.	—	—	756	49
Coffee, raw and roasted .... lbs.	Raw only (1905). 25,949	362	55,530	1,220
Corn, Grain and Flour				
Barley .... lbs.	—	—	16,319	78
Bran .... lbs.	—	—	21,132	88
Oats .... lbs.	83,157	278	35,673	180

STATEMENT OF QUANTITY AND VALUE OF GOODS EXPORTED, ETC.—(*Contd.*)

Articles.	1905.		1906.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Corn, Grain and Flour—(*Continued*)				
Kaffir Corn .... lbs.	94,522	329	306,889	1,061
Maize .... lbs.	341,388	994	743,305	2,107
Wheat .... lbs.	—	—	35,460	171
Other kinds of grain .... lbs.	—	—	45,024	288
Flour, wheaten .... lbs.	—	—	163,109	825
Other kinds of Flour or Meal .... lbs.	—	—	500,605	1,773
Eggs .... No.	124,980	1,459	191,533	1,538
Fruit—				
Bottled or tinned .... lbs.	—	—	6,987	183
Dried .... lbs.	—	—	20,355	322
Fresh .... lbs.	—	5,101	—	6,514
Jams and Jellies .... lbs.	—	—	9,989	206
Lard .... lbs.	—	—	3,174	63
Meats—				
Beef, Fresh (*i.e.*, frozen) .... lbs.	—	—	48,579	668
Mutton, do. .... lbs.	—	—	30,683	601
Pork do. .... lbs.	—	—	225	5
Poultry or Game .... lbs.	—	—	—	22
Salted or Cured (not tinned) .... lbs.	—	—	27,584	980
Tinned or similarly preserved .... lbs.	—	—	29,838	633
Milk or Cream (condensed, etc.) .... lbs.	—	—	35,864	739
Mustard .... lbs.	—	—	163	5
Oat Meal .... lbs.	—	—	2,149	19
Oil, salad or olive .... galls.	—	—	—	49
Pickles and Sauces .... lbs.	—	—	3,058	100
Rice .... lbs.	—	—	27,603	130
Salt, common and table .... lbs.	—	—	59,423	123
Spirits—				
Brandy .... galls.	—	—	696	388
Gin .... galls.	—	—	127	54
Rum .... galls.	—	—	—	8
Whisky .... galls.	—	—	1,256	837
Other kinds .... galls.	—	—	48	24
Sugar—				
Raw or unrefined .... lbs.	—	—	57,710	473
Refined and Candy .... lbs.	—	—	74,343	773
Glucose, Molasses, Treacle, etc. lbs.	—	—	6,767	84
Tea .... lbs.	12,899	619	8,829	351
Vegetables—				
Onions .... lbs.			66,572	414
Potatoes .... lbs.		3,198	235,442	1,403
All other fresh vegetables .... lbs.				2,952
Tinned or otherwise preserved .... lbs.				185
Wine—				
Still (S.A.P.) .... galls.	—	—	681	270
Still (not S.A.P.) .... galls.	—	—	964	519
Sparkling	—	—	325	443
Hair, Angora (Mohair) .... lbs.	182,618	6,654	414,690	19,097
Hides and Skins—				
Hides, Ox and Cow .... lbs.	—	—	1,211,926	35,108
Hides, Calf .... lbs.				
Hides, Goat .... lbs.	—	—	—	28,671
Hides, Sheep .... lbs.				
Hides, Wild Animal .... lbs.				
Hides (N.O.D.) .... lbs.	—	—	—	207

STATEMENT OF QUANTITY AND VALUE OF GOODS EXPORTED, ETC.—(*Contd.*)

ARTICLES.	1905.		1906.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Hops	—	—	—	10
Horns—				
Ox and Cow ...lbs.				
All other ...lbs.	—	—	—	2,112
Implements—				
Agricultural	—	—	—	2,905
India Rubber and Gutta Percha—				
Old ...cwts.	—	—	340	550
Manufactures of ...cwts.	—	—	—	985
Leather Goods—				
Boots and Shoes	—	—	—	14,471
Saddlery and Harness	—	13,299	—	9,007
Manufactures (N.O.D.)	—	5,967	—	4,693
Unmanufactured	—	661	—	420
Machinery—				
Agricultural	—	—	—	6,205
Manures and Fertilizers ...lbs.	—	—	163,030	374
Plants, Bulbs and Trees	—	—	—	1,470
Seeds of all kinds	—	—	—	2,503
Sheep Dip	-	—	—	109
Soap—				
Common ...lbs.	—	—	28,238	327
Toilet Soap and Extracts	—	—	—	109
Tallow and Grease	—	—	—	79
Tar, Asphalte, Pitch, etc	—	—	—	93
Tobacco—				
Unmanufactured ...lbs.				
Manufactured ...lbs.	861,573	60,923	136,095	4,729
Cigars ...No	640,025	2,301	lbs. 3,871	1,738
Cigarettes ...No	9,644,800	9,725	lbs. 81,885	27,940
All other ...lbs.	—	—	1,106,598	71,441
	See above—Tobacco manufactured and unmanufactured.			
Tobacconist's Wares	—	1,788	—	1,892
Vehicles—				
Carriages and Carts	—	—	—	12,279
Wood & Timber—				
Unmanufactured				1,291
Manufactured				
Houses and Frames		6,805		310
Whipsticks				100
All other kinds				2,691
Wool and Manufactures of—				
Raw Sheep's Wool, washed				
Sheep's Wool, scoured	3,323,541	8,5128	5,299,371	143,023
Sheep's Wool in the grease				
Manufactured—				
Cloth and piece goods	—	—	—	1,938
Blankets, Rugs and Shawls	—	—	—	2,851
All other kinds	—	—	—	571

Plate CLI.

An Ornamental Tree of the Transvaal.

The Van Wyk-hout or Mzawthlu (*Bolusanthus speciosus*—Bolus Harms.)

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AGRICULTURE IN AMERICA.

By William Macdonald, MS.Agr.

No. I.

In the second week of last April the writer was granted six months' leave of absence by the Department, and, having decided to spend part of his vacation in studying the latest methods of agriculture, crossed over to the New World. As most of our farming population are more or less interested in the agricultural industry of the Great Republic, it may be of interest to give at the outset a short account of this tour; and, later, to discuss in detail some of the prominent features of the various methods in vogue. But since we have already received several requests for information on a certain subject, namely, "Dry Land Farming," we propose to deal with it in the columns of this "Journal." (Plate CLII.)

We arrived in New York on the 18th of May, and went by way of Chicago to the State of Minnesota. Minnesota is one of the leading wheat growing States of the Union, and at this particular station some remarkable results have been attained in the improvement of several varieties of wheat by selection and hybridization—a work which has materially enriched the farmers of the North West. Of special interest is the "Centgener* Plot System" and the

*Centgener, combining the root words *centum* (hundred) and *genera* (generation), a hundred more or less (a large number) with a common parentage, was a word devised by Prof. Hays to aid in comparing the prepotency and breeding values of parents used in breeding by comparing the averages of a large number of the progeny of the respective parents. Centgener power means nearly the same as prepotency, as used in animal breeding, but is better adapted to use in hermaphroditic plants, with the male and female parents on a single plant. The term centgener tests may be usefully applied to breeding animals as well as to mother plants. The owner of twenty trotting-bred mares having the choice of breeding them to a stallion with a record of 2.10 with many colts with records of 2.30, or to another stallion with a record of 2.30 but with many colts with records of 2.10, would at once choose the sire showing the best ability to get fast horses. The breeder of wheat, once he has under comparison the average yields for three years of plats of 100 of the progeny of the respective mother plants, pays little attention to the individual yields of mother plants. Centgener measures of mother plants or of breeding animals are much safer guides to their values as parents of improved strains than are measures of the individual qualities of parents.

"Pedigree Book," by which it is possible to follow with exactitude each wheat plant and to trace its progeny power through the thousands of individuals which are at present growing in the trial grounds.

This work in plant breeding was begun by Professor W. M. Hays, now Assistant Secretary to the National Department at Washington; and it was our privilege, through the courtesy of the President of the State University, Dr. Cyrus Northrop, and the Professors of the Agricultural College, to spend several weeks at this Experiment Station. In company with Mr. C. P. Bull, Assistant Professor of Agriculture, the daily testing of wheat in the railroad trucks was studied under the State Inspectors; the methods of handling the grain in the elevators, and the classification of the various grades in the laboratories of the State Grain Inspection Bureau. We might mention that every carload of wheat that enters or leaves Minnesota is subject to the strictest State examination. In Minneapolis—the most important milling centre in the world—we had the opportunity of seeing the famous Pillsbury Mills, which turn out on an average 35,000 barrels of flour in a single day. (Plates CLIII. and CLIV.)

During a visit to the south-western portion of the State, we spent some days with Mr. O. C. Gregg, the Superintendent of the Farmers' Institutes at the Coteau Farm, and from him we learned much of interest regarding the work which is being done by the State for the farmers. A fuller account of these and other agricultural matters will appear in the second paper of this series. A fine forty-acre field of clover on this farm was a striking example of the possibilities of this plant in restoring fertility to the worn out wheat lands of the State. Many of the farmers in this section of the State are turning all their grain into cattle and hogs, and greatly increasing the area of their pasture lands. We were particularly struck with the rich pastures all along the course of the Minnesota River, as well as by the pleasant groves which enhance the beauty of almost every homestead.

At Brookings, South Dakota, we inspected the State Farm, where an admirable work is in progress under the direction of Professor Hansen, who has done so much in developing new fruits specially adapted to the vigorous winters of the North-West. Such work as this would prove of inestimable value for our high veld in the districts of Carolina, Ermelo, and Wakkerstroom. In Horticulture, the main line of investigation is the hybridizing of strawberries, plums, pears, apples, cherries, apricots, grapes, raspberries and roses. We were especially interested in the dwarf fruit trees and the graft hybrids. Mr. Haralson, Foreman to the Department, informed us that it has been found advisable to do all crossing, as far as possible, in the greenhouse. He also mentioned that Professor Hansen, in order to save time, had given up bagging the emasculated and artificially pollinated flowers, and trusted to chance for a pure cross—thus the possibility of mixing by wind pollination is ignored. We must say that this saving, both of time and labour, by this simple

method rather appealed to us; but whether it is not more suited to the working nurseryman than to the agricutural expert is an open question. For registration purposes, the centgener plan is used in numbering nursery varieties, after which the new hybrids are sent out to the farmers under a common name, as for instance, the Sunbeam Raspberry. (Plate CLV.)

After leaving the North-West we journeyed through the States of Wyoming, Utah, and Nevada to San Francisco. In California we had the pleasure of meeting the celebrated plant breeder Mr. Luther Burbank of Santa Rosa.

Leaving Berkeley at 7.25 a.m. we crossed over the Bay to Valligo and reached Santa Rosa at 11 a.m., which is situated some 52 miles to the north of San Francisco. Santa Rosa is a pretty town of some 10,000 inhabitants, and is surrounded by many small, prosperous, and highly-cutivated farms, being the distributing point for much fruit, wine, hops, eggs, etc. At the time of our visit, the town was still a mass of ruins, having suffered terribly in the recent earthquake; nevertheless, the people were busy at work re-building with their characteristic courage and cheering optimism. The home of Mr. Burbank is picturesquely situated a short distance from the town in a garden of creepers and palms, and shaded by the stately hybrid walnut tree about which so much has been written. In his Home grounds you find many beautiful flowers, such as the Iceland, Oriental, and Californian poppies; the lovely Shasta daisies and the varied hued verbenas; amongst vegetables, there are beds of disease-resisting potatoes, different pumpkins, some economic grasses, a host of other things and the famous spineless cactus complete the list.

Seven miles from Santa Rosa lies Sebastopol, where the larger experimental grounds of Mr. Burbank are situated. The two towns are connected by an electric car, and, incidentally, it may be worth mentioning that this tram system has done a great deal to forward the agricultural interests of this section. Before the advent of the electric railway the fruit had to be shipped eight miles or more in waggons, with the result that a large quantity was damaged. Now, electric cars run right to the farmers' doors. Peaches, apples and berries are transported in regular freight cars. The cost of this railroad averaged $40,000 (£8,000) per mile, and was built by an Eastern Syndicate. With such facilities, the rise in the price of land has been rapid, and apple, berry, and grape orchards are now selling from $300 (£60) to $400 (£80) per acre, and unimproved ground at from $100 (£20) to $150 (£30). The railway runs from Forestville to Petaluma, a circle of 25 miles, and the whole trip costs only 35 cents (1/5). One could not help thinking what a benefit such a scheme would confer on many of the remoter parts of the Transvaal. When it is remembered that Sebastopol is a town of from 1,200 to 1,300 souls, the enterprise of the district is most commendable. Sebastopol nestles in a lovely valley surrounded by a range of

mountains and lies 18 miles from the Pacific Ocean. The soil is a sandy loam and irrigation is not practised. The rainy season begins about the 1st of November and lasts towards the end of April; there is practically no rain in summer, only the ocean fogs.

At Sebastopol, Mr. Burbank increases the selected stock which he has started at Santa Rosa. The general method of work is as follows:—

The seed from the best trees is carefully gathered and planted. When the young trees are about a year old they are grafted into older stocks, and in a relatively short time (two or three years instead of five or six) it is known what fruit is likely to result. If it does not prove satisfactory those grafts are then destroyed and another variety inserted. Should the graft turn out well, cuttings are taken from it and propagated in quantity. In one apple tree, Mr. Burbank inserted over 200 different grafts. As many as 35,000 grafts are put in every year. Last year, 78 French prunes were grafted to the stoneless variety with an average of 90 grafts to each tree. The number of scions inserted at Sebastopol would probably reach half a million. Most toil and time have been expended on plums. There is almost every possible variety, and the great majority of trees are bearing heavily. In this garden they receive no special treatment, and with more care and freer space there would certainly be an increase in productivity.

It is rather hard to accurately gauge the true character of Mr. Burbank's researches as so much of his work is still unfinished; nevertheless, it can safely be said that Burbank has been the foremost pioneer in this new field, and by his bold experiments, heedless of all past tradition, he has called world-wide attention to the marvellous possibilities of hybridization. For this alone he must be accorded high rank amongst modern Horticulturists. Moreover, his extraordinary success has done much to create a new Science, namely, that of Plant Breeding, which is destined to play an important rôle in the New Agriculture; and, at the same time, he has stimulated a host of other workers throughout the length and breadth of America, prominent amongst whom are such men as Webber of Washington, Hansen of South Dakota, Munson of Texas, and Bull of Minnesota, who are all doing a splendid and lasting work in their respective lines.

For our part, in place of the spineless prickly pear, we should prefer to see the evolution of a drought-resistant cereal—a wheat or maize, or oat or barley—which would stand unwilting amid the glowing sands of an arid waste—the herald of a new era in dry land agriculture. But we venture to believe that the fairest passage on the work of Mr. Burbank is from the pen of the most distinguished agriculturist in America, Professor L. H. Bailey, Director of the Cornell College of Agriculture, who writes as follows:—

"The practical results that Mr. Burbank has secured have been praised beyond all reason. His place abounds in interesting and surprising things, just as would be expected of any other man's place

if conducted under similar conditions. His work has been so much written about that it is not necessary to try to make any catalogue of the things that are under his hand. The number of really useful things that have been introduced by Burbank is proportionally small, although it is not too much to hope that some of his productions, as the plumcots, may be the starting points of strong and novel lines of evolution. Some of those that have been most heralded are of doubtful economic value. This is true, I think, of the much-vaunted spineless cactus. Several species of opuntia (to which genus Mr. Burbank's spineless cactus belongs) are spineless. Spineless cacti have long been known in Mexican and other gardens.* By continued selection, the more or less spineless forms can be singled out and the smooth character perhaps intensified. Mr. Burbank may be able to eliminate the small spicules and to improve the plant in the edible qualities of its fruits and stems. There is no doubt that he has the spineless cactus in quantity. It is a pleasure to see him rub his face against the pads to determine whether the spines are really there. But what use shall we make of it? It is said that we shall plant the deserts, for the cattle can eat this spineless cactus, and thus will the food supply of mankind be immensely multiplied and the welfare of the race enhanced. The cattlemen now singe the spines from the wild cacti by means of gasoline torches, and this is much cheaper than to plant the desert; and experiments show that if the desert were planted with spineless cacti, the young plants would be destroyed if the cattle and jack-rabbits were allowed on the ranges; this would mean fencing the deserts. If the spineless cacti are grown from seeds, some of the progeny will probably be spiny; these, and the native seedlings, will have to be uprooted and this will probably entail more expense than the enterprise will be worth. If, in addition to this weeding, the plants are set out from cuttings, the desert becomes practically a cultivated ground. Moreover, it is undetermined whether Mr. Burbank's cactus is really a desert form. Some of the deserts will be irrigated, and then cacti will not be wanted; and if the deserts are to be planted at all, it is a question whether cacti are the best plants with which to stock them.

"All this leads me to say that the value of Mr. Burbank's work lies above all merely economic considerations. He is a master worker in making plants to vary. Plants are plastic material in his hands. He is demonstrating what can be done. He is setting new ideals and novel problems. Heretofore, gardeners and other horticulturists have grown plants because they are useful or beautiful; Mr. Burbank grows them because he can make them take on new forms. This is a new kind of pleasure to be got from gardening, a new and captivating purpose in plant growing. It is a new reason for

*Mr. Burtt-Davy, the Botanist to the Agricultural Department, informs us that the Spineless Cactus was introduced into the Transvaal by the early settlers: and this species is now being propagated in the Botanical Experimental Station near Pretoria.

Personally, we have seen a Spineless Cactus growing wild in the South of Spain. [AUTHOR.]

associating with plants. Usually, I think of him as a plant-lover rather than plant-breeder. It is of little consequence to me whether he produces good commercial varieties or not. He has a sphere of his own, and one that should appeal to a universal constituency. In this way, Luther Burbank's work is a contribution to the satisfaction of living, and is beyond all price."* (Plate XVI.)

At Berkeley, where the University of California is situated, we spent some time with Professor Wickson, the author of the standard text-book on "California Fruits." In this Department, we also met Dr. Hilgard, the distinguished Agricultural Chemist. This gentleman has devoted a life-time to the study of "Alkali Lands" with such success that he is known as the "Soil Wizard of the West." Along with our friend Dr. A. W. Ward, a former Cornell class-mate, now Bacteriologist to the University of California, we visited the town of Petaluma, a famous chicken-raising centre, where we saw some 40,000 White Leghorns being fattened for market. Sonoma County, California, is the greatest poultry-raising district in America. A recent Census credits this county with an annual output of 3½ million dozen eggs and over half-a-million fowls.

At Los Angeles we met Mr. H. B. Gurley, the Acting Secretary of the Chamber of Commerce, who gave us much valuable information regarding the methods adopted in advertising the agricultural products of California, and the arrangement of the exhibits from the various counties in a spacious permanent hall open daily to the public. There is also a Californian Bureau of Exhibits at Atlantic City, New Jersey, a fashionable watering place, where over two million people congregate during the season. We were much struck with the enterprise of this Chamber of Commerce, and the cordial and practical support it receives from the farmers of the seven southern counties. Proper advertisement by business men cannot fail to have a far reaching effect upon the general prosperity of any State. Last year, over 25,000 carloads of oranges and lemons were shipped from this centre, representing over $20,000,000 (£4,000,000).

We would strongly recommend the establishment of a permanent bureau of agricultural and industrial products in Pretoria and London under the auspices of the Chambers of Commerce of the Transvaal and the Department of Agriculture. Amongst the many and varied products which have won for California a world-wide reputation, we can say without exaggeration that there are none we cannot grow, none we may not equal, and none we may not hope to excel.

It was our good fortune to spend several days amongst the citrus growers of Southern California, and here, in the home of the Navel Orange, we found much to learn. Riverside, a beautiful and prosperous town of some 12,000 inhabitants, has risen altogether on the orange industry. Last year, over 5,000 carloads of oranges and lemons were shipped to the Eastern Markets from this enterprising

*Plant Breeding, p. 243.

community. When one reflects that to transport citrus fruits from California to London takes three weeks and sometimes more, it needs no optimist to forecast a great future for the orange industry of the Transvaal, more especially when we can place our citrus fruits on the London market both in summer and winter. Nor is there any reason why, in due season, Rustenburg, Warmbaths, and the Zoutpansberg should not rival Riverside. (Plate CLVII.)

In Utah and California we were greatly impressed with the manner in which the farmers irrigate. Certainly, so far as regulating the flow of water is concerned, a high standard has been reached—a striking contrast to the wasteful methods too common in many parts of South Africa. In the West, the moment the ground is dry, the irrigation furrows are broken up with various types of harrows and smoothers, and a few days later the land is smooth and loose and mellow, forming a moisture conserving "dust blanket" or "mulch," For scientific irrigation, combined with good tillage, over large areas, we know of nothing to approach the practice of the Californian farmer.

At Manhattan, where the Kansas State Agricultural College is situated, Mr. A. M. Ten Eyck, Professor of Agronomy, gave us much valuable information. He spoke specially of the benefit of dry land farming and the importance of spreading the gospel of agriculture by the missionaries attached to the wheat and corn train.

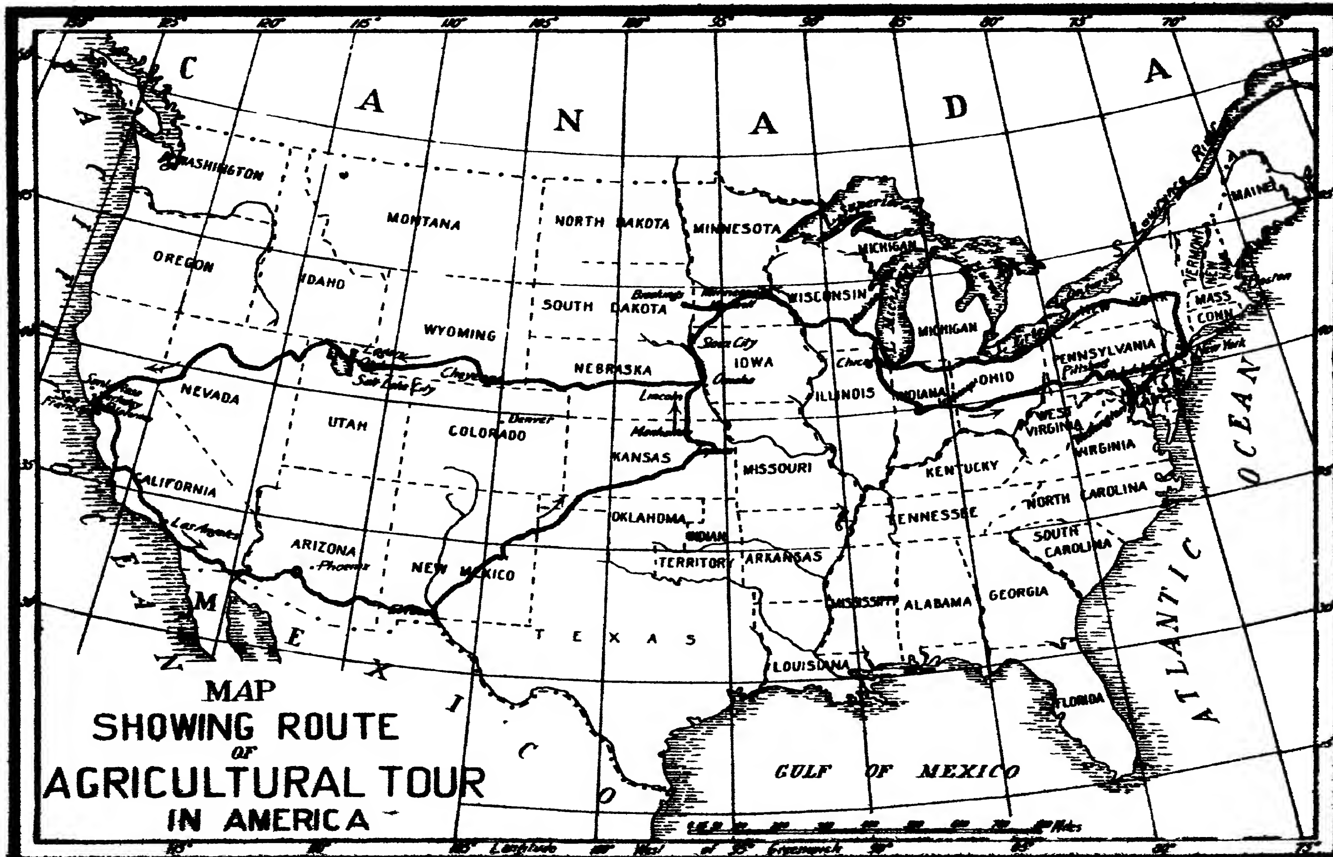
This method of disseminating agricultural information is exercising such a wide and important influence all over the West that we have not hesitated to insert the following paper which comes from the pen of a brilliant and lucid agricultural writer, Mr. W. H. Ogilvie:—

"Among the many different means employed by those interested in disseminating agricultural instruction among the farmers of the United States there is none more enterprising or original than that which is now familiarly known as the 'Gospel Train.' At some of the leading agricultural colleges the more earnest of the expert workers, had come to bemoan their limitations in the matter of spreading certain truths in corn-growing which, had they been widely circulated, these men felt confident would have done much towards the economic advance of arable farming in those States in which they were particularly interested. They had done all that it seemed to them possible to do in the way of writing articles in the agricultural Press, and of inviting and answering questions in the correspondence columns of those papers which devoted themselves especially to the interests of the farmer. They had missed no opportunities of fulfilling lecturing engagements at county clubs and farmers' institutes, travelling great distances—often at much personal inconvenience—in the intervals of their own absorbing college work, to impress their theories, widely becoming well-proven facts, upon the more illiterate, but no less enthusiastic, men who have of late years looked to them so largely for guidance. In addition to this they had caused to be

distributed from their own colleges a considerable amount of agricultural literature in pamphlet form—detailing their daily observations and constant research both in the laboratory and in the field. All this they had done; and still in the breasts of many of them rankled the consciousness of a work not to the uttermost performed, of a constituency not fully converted, of high ideals of usefulness not fully attained. There must be some further way, they argued, of bringing this gospel, which was theirs to preach, within reach of the many thousands of farmers who were waiting in unanimity of eagerness and enthusiasm to accept the truth from their lightest word.

"A couple of years ago these lofty and ambitious desires bore fruit in the State of Iowa, the greatest corn-growing State of the Union, in the fitting out of a *corn train*. (In speaking of corn it is well to note that *corn* in America always means maize or Indian corn, the term *grain* being used in referring to wheat, oats, barley, etc.) It is not absolutely on record that Iowa was the first State to affect the Gospel Train—the honour is sometimes claimed by the neighbouring State of Illinois, also a prominent corn district—but in any case, Iowa was the first to run a corn train over a distance of thousands of miles into the remotest corners of her mighty territory, and the first to bring them into that complete and satisfactory state of organisation which has made the scheme a memorable and effective one.

"In the nicety of practical science to which our progressive American cousins have reduced—or, rather, elevated—the business of farming, the tendency has been more and more to develop the specialist; the professor of soils, the master of sheep husbandry, the expert in hogs, the authority on oats, and so on. Professor Holden is a specialist, and his speciality is corn. His colleagues have playfully prophesied that when he dies the word *corn* will be found graven upon his heart. It is corn that has carried his name to the furthest boundaries of Iowa, and far beyond them. In Ohio, in Illinois, in Nebraska, in Kentucky, this expert's name is a household word—simply because these States are corn States, and wherever corn is known there is Professor Holden known too—if not in person, at least by reputation and authority. At the Iowa State College of Agriculture, which is looked up to, not only locally but nationally and in the world's eyes, as a leader in all things pertaining to the science of the farmer's profession, P. G. Holden, Vice-Dean of Agriculture and Head of the Department of Agronomy in that institution, is one of the most prominent men. Capable, energetic, daring in resource, aggressive yet cautious, this man is a good type of the class that is doing so much to make the American farmer in method the most serious, in result the most successful, in the known world. Personally he is an instance of the success that comes of following up without any deviation one particular idea, owning one speciality, being master—and thorough master—of one particular



MAP
SHOWING ROUTE
OF
AGRICULTURAL TOUR
IN AMERICA

ROUTE SHEWN IN RED

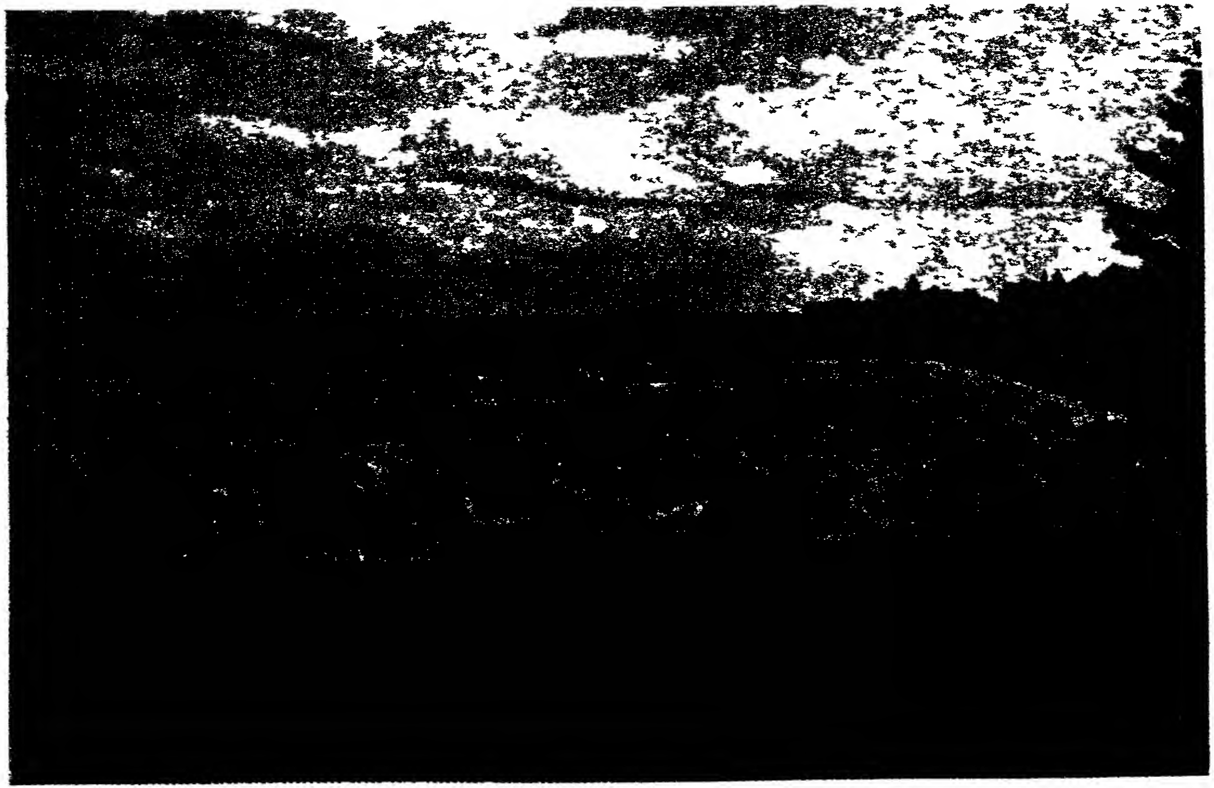


Plate CLIII **A New Fife Wheat** (*Minnesota No. 163*)

Showing the first five acre field in 1898. This variety was originated in 1892 and distributed to the farmers of the State in 1899. It yielded 2.4 bushels per acre more than the common varieties representing an annual gain of over one million dollars to the North West.—Minnesota Experiment Station College of Agriculture

subject. For some years this earnest and useful member of the inner circle of American agriculture has devoted his time and attention to one particular branch of his own particular work. With other experts in maize culture he has long been of opinion that a conscientious and rational system of seed selection was the only means by which the corn crop of the State could be rapidly and permanently improved. For this careful selection of seed corn he has long pleaded not only in his own classroom, but upon the public platform and in the public Press. He has compiled at considerable expense of time and labour, and with infinite care, a pamphlet dealing exhaustively with this important subject in all its phases, showing by letterpress and copious illustration exactly the procedure to be followed in the successful selection of seed corn. This pamphlet has been issued as an ordinary bulletin by the experiment station of the Iowa State College. Some 50,000 copies have already been distributed among the farmers of the State, and the demand for the work is constant as each fresh seed-time arrives.

"It has been said that a man deserves well of his country if he has succeeded in making two blades of grass grow where one grew before, and, if this is so, Professor Holden, of Iowa, surely deserves well of his State, for it is estimated that in the last two or three years he has by his teaching improved both the quantity and quality of Iowa corn to the value of some millions of dollars. Be this as it may, Professor Holden's name will always be inseparably connected with this newest departure in American agricultural methods—the organisation and successful running of the Gospel Train—for it was to propound to the people this Professor's theories of seed selection that the railway train as a lecture-room was first exploited in Iowa.

"In considering the necessities which arise for some such means of getting in closer touch with the farmers, we must remember that one of these huge States will contain from two hundred and fifty thousand to three hundred thousand farmers, for the most part men of ambitious and enthusiastic temperament, who clamour for more assistance than one agricultural college, however well organised and capably manned, can possibly give them.

"The most that such a college can do is to take and educate a percentage—an absurdly small percentage—of these farmers' sons; to give these farmers themselves, if they can spare the time and money to travel some hundreds of miles to the college itself, a short course of two weeks of instruction in the year; and to send out experts whenever possible to lecture at farmers' clubs and institutes. It stands to reason that even these progressive methods leave a very large proportion of the rural population unapproached and untouched. Yet these men in the far-off corners of the State are just as anxious as their more fortunately situated neighbours to have the gospel of progress preached to them; and in Iowa the corn train has solved the difficulty.

"It does not transpire who was the brilliant originator of this idea of travelling through the country by special train to lecture to the farmers of remote districts, but the College authorities took it up at once with enthusiasm. Three of the prominent railway companies, whether from public spirit or a far-seeing policy, guided by the prospect of future carriage receipts increasing with an increasing corn crop, offered to put special trains at the disposal of the College men, trains which should stop at every single station upon their lines, thus giving every farmer a chance to come and hear for himself, in the words of their strongest advocate, the details of methods of which he had only heard a faint murmur from the outside world. A party of corn experts, consisting of Professor Holden himself, a sub-professor, and a couple of graduate students, was soon formed. A director of the railway company, a couple of journalists, and a cook, made up, with the train attendants, the little band which went out to spread the gospel of good seed corn in this original and novel manner.

"A programme was quickly arranged, and large bills were printed and exposed at the country stations setting forth the plan of the route and the exact minute at which the train would draw up at the platform. The farmers were requested to make an effort to come to their railway town on that particular day, and loyally they responded to the appeal. Each town as it was reached disclosed the same apparently endless row of farm waggons and buggies, the horses hitched to posts at the side of the long main street, while their owners thronged the town hall or the platform of the railway station to await the coming of the gospel train.

"If the town was one of some size and importance the meeting was held in the public hall or Farmers' Institute. If it was small and unimportant, or merely a wayside platform in the wilderness, the lecture was given in the train itself. For this purpose a long corridor carriage was used, which would seat eighty to a hundred men—this being ample accommodation for the small numbers which came to any of the smaller stations. As the train drew up the farmers on the platform were ushered into this carriage, Professor Holden or one of his assistants would lecture for twenty minutes—which was the limit of time allotted—the farmers would file out, and promptly on time the gospel train would get up steam and whirl away its little band of agricultural enthusiasts to the next station, where already the platform was filled with a waiting crowd of eager-faced boys and men, who hailed with a cheer the train as it drew up to repeat the programme of the last stopping place. The trains were run with most commendable promptitude, and in no case were the farmers either disappointed of an appearance or wearied by a long wait. The interest displayed at every point of the route was a thing to remember; there were no doubting faces and no cynical ones. If there was a humorous side to this hasty and typically American manner of tossing crumbs of agricultural information to a State in the twenty minute

pauses of a hurried railway journey, no one present seemed to appreciate it. Every meeting, whether in town hall or railway carriage, went off with absolute decorum and concentrated earnestness of attention, and the Professor and his assistants came in for much appreciation and thanks, personally delivered whenever time permitted.

"An educational sally of this kind ventured in England would arouse only antagonism and open ridicule—one cannot imagine it being attempted at all; but in America it seemed to suggest nothing incongruous or superficial—simply a brave effort on the part of a few determinedly enthusiastic College men to sow as much good seed, literally and figuratively, as possible in the two short weeks at their disposal.

"The agricultural and city Press lent their powerful aid to the movement; other railway companies came forward with the offer of special trains, and everywhere the startling innovation met with the greatest success.

"The most telling proof of the popularity of the movement was to be found in the large numbers of farmers who at all points availed themselves of this opportunity to hear expert opinion on a matter closely concerned with their daily interests and commercial prosperity. There may have been—undoubtedly there were—some few who were too bigoted and self-opinionated to think it worth while to take any hints from specialists who had made the growing of corn their life's study, but these men were not in evidence in the crowded town halls, where the Stars and Stripes flanked the huge maps and diagrams of good and bad seed corn upon which Professor Holden pointed his obvious moral, nor were their faces to be seen among those eager ones in the long railway carriage, fixed with such keen interest upon the man who was holding their attention with every word he spoke.

"That the corn train had done its work well as a pioneer was soon proved by the urgent demand for a dairy train, which immediately followed. This was conceded, and its success led to the sending out of a good roads train, in which a number of experts preached towards the improvement of the highways. Generally speaking, this novel means of reaching the outlying farmer is ensured of continued success, and in the educational economy of American agriculture the gospel train has undoubtedly come to stay."*

After leaving California we travelled through Arizona, Texas, Oklahoma, Kansas and Nebraska, visiting the Experiment Stations in Kansas and Nebraska; while in Topeka, the Capital of the former State, we called upon Mr. F. W. Coburn, the Secretary of the Kansas State Board of Agriculture. Mr. Coburn has devoted practically the whole of his life to the farming interests of Kansas. His novel and attractive advertisements, which appear on all the

* *The Scotsman*, November 7th, 1906.

Society's letters, circulars, bulletins, leaflets and reports have done a great deal to stimulate immigration and further agricultural settlement; his success in this direction has been so remarkable that he has gained not only the respect of all the farmers of his own State, but of the whole nation, and, the other day, he was offered a seat in the United States' Senate. It is strange to reflect upon the wonderful transformation of Kansas: twenty years ago it was known simply as a land of hot winds, blizzards, and heartrending droughts; while but yesterday the wheat crop of the Sunflower State for one year was close on a hundred million bushels, and she can boast, in a single decade, the overwhelming total of two-and-a-half billion bushels of corn (mealies).

On our homeward journey we spent four days at Washington, and visited the Federal Department of Agriculture. At the Department we were cordially welcomed by the Acting Secretary of Agriculture—the Hon. W. M. Hays—who rendered us every possible aid. The Secretary of Agriculture, Mr. Wilson, was not in the Capital, being absent on official duties, in connection with the supervision of the new law relating to packing houses. Secretary Wilson, to whom the present development of the Department is mainly due, is a genial Scotchman, who was called from the chair of Agriculture in the Iowa Agricultural College to fill the most important post in his profession. Both Mr. Wilson and his assistant are men who combine a knowledge of practical farming with a long scientific training, and both are endowed with a rare executive ability. America is certainly to be congratulated that she can call on two of her Western College Professors to fill the chief posts in the most important of all Government Departments. Nor is it improbable that the life on the Western Prairies has had something to do with the development of those qualities which enable both experts to deal so successfully alike with a critical Congress and the conservative farmer.

As already noted, Professor Hays was not only one of the first in America to start systematic improvement of farm crops by hybridisation, but he likewise invented and applied the centgener method of registration which enables the pedigree of each individual plant to be traced with ease through any number of generations, and of still greater importance, provides the needed systematic method of measuring the breeding powers of large numbers of selected *mother plants.* He is also specially interested in economic farm management, and, for several years, has been engaged in the compilation of statistics relative to the cost and production of farm crops—the results of which promise to prove most instructive.

Moreover, Professor Hays has been closely identified with the development of the farm schools of the North-West, and he is strongly in favour of the consolidation of the country school, as far as practicable, in areas of about five miles square with vans to transport the pupils.

In discussing the revision of the packing house laws, Professor Hays stated that South Africans need have no fear of purchasing American canned goods after the 1st of October, when the new regulations will be rigorously enforced. He also mentioned that the Pure Food Law would be put into action on the 1st of January, 1907, and, in future, all canned goods for export must bear the Government label. Personally, we look forward to the day when our own Colonies will be in a position to supply the Homeland with clean meat, properly packed, and under the most stringent Government inspection.

We were specially interested in meeting Dr. Webber of the Bureau of Plant Industry whose new citrus and cotton creations have attracted world-wide attention. Various other officers gave us a large portion of their valuable time.

Whilst in Washington we met Senator F. M. Cockrell, of Missouri, a member of the Interstate Commerce Commission, who generously gave us numerous statistics in regard to railroad rates for agricultural produce; and Mr. George F. Pollock, Assistant Commissioner-General of Lands, kindly afforded us much instructive information respecting land settlement and the method of disposing Crown Lands in the United States.

Under the homestead form of law, title may be obtained without any charge except the simple fee for the filing of papers. This is the Free Homestead Law, enacted in 1862, under which the greater portion of the public domain has been settled. Over 100,000,000 acres have been settled in this manner. The Federal Government has no large blocks of land for sale, the object being to encourage close settlement, and the Homestead Law is considered the only possible solution to a successful and permanent land settlement. Although 160 acres is the common allotment, in some States—as on the high and sandy lands of Nebraska—640 acres are granted; and the idea is rapidly gaining ground that 1,000 acres would still be better, for a farmer could then raise enough winter feed to carry over his cattle through the austere winters of that western country. The original land scheme was devised to give the farmer 1,280 acres (or two sections), but this area was reduced by Congress. There is also provision for "Desert Lands," only a nominal fee is charged, but the claimant is required to expend at least $1 (one dollar) per acre for each of three years, and to show proof of reclamation. Timber lands are sold at $2½ (10s.) per acre; practically all of the valuable timber has been sold except that embraced within forest reservations, which have been created to preserve the waterfalls of the country, or historic relics, or ancient Indian ruins. These reservations are mostly in the mountainous parts of the country. The *Tree Claim* has not proved a success. In the early days of settlement, a Colonist who planted 10 acres of trees was entitled to claim 160 acres, free of charge. This led to many fraudulent claims being recorded, and in 1891 it was repealed. It is customary in America to dispose of the fee even

to the minerals of the land. When an applicant has completed all prescribed conditions, a patent is issued giving complete title or fee to the land, viz., entire control of all he may find thereon; but already there is a movement towards the retention by Government of minerals that may be found on public lands so that the State may secure some profit.

From Washington we returned to New York, and left for England on the 28th of August. Whilst in New York we visited the Nurseries of Mr. C. W. Ward, of Queens. Mr. Ward is the largest carnation grower in the United States. Here we saw twenty-six glass houses given up entirely to carnation culture, the annual output of cut flowers being over one million. These, and further matters of interest, we propose to deal with in due course in the pages of the "Agricultural Journal." It would take too long to touch on the many phases of agriculture which one sees when travelling throughout the West, and we must now turn to Dry Land Farming.

Dry Land Farming.

A few years ago we studied farming in the West. Since then the change of opinion and method has been little short of startling. At that time progressive agriculturists would have ridiculed the idea of growing crops without water on the arid and semi-arid plains, but the return of many farmers to the abandoned drought-stricken prairies of Western Kansas and Nebraska is founded on no mere wave of passing enthusiasm. And desert lands, which since by-gone ages have produced nothing but sage-brush and greasewood and yuccas, are now giving place to waving grain fields and fruitful settlements. All this is due to dry farming.

The problem of dry land farming may be said to consist of two factors: the scientific culture of the soil for the maximum conservation of moisture, and the growing of drought-resistant crops specially adapted to the diverse agricultural zones. We discussed this subject not only with practical farmers throughout the Western States, but also with such authorities as Dr. Hilgard, of California, Dr. Elwell Mead, and Professor Hays of the Washington Department of Agriculture. In speaking of dry farming, Professor Hays mentioned that the Federal Government had just acquired an area comprising some 330,000 square miles in the great plains of the West, where fifteen experimental sub-stations, in co-operation with the several State stations, are being established for testing the best methods of conserving soil moisture and of raising crops in these desert regions. But it is the State of Utah which has been the first in this new field. And a few facts cannot fail to be instructive. The total area of the Mormon Commonwealth is 82,190 square miles or nearly three-fourths that of the Transvaal. The splendid place which this State has taken in the Union is undoubtedly due to the irrigation. But, at the present moment, only 983 square miles are under water, or a little more than

1% of the land of the State. For the sake of argument, increase the irrigated area to 10,000 square miles, and yet only a trifle more than 12% of the State will be under irrigation farming, leaving 72,000 square miles, or nearly 45,000,000 acres, of arid lands. The soil of these millions of acres is fertile; the rainfall is low; they are covered with sage-bush, greasewood and sunflowers; there is no possibility of irrigating these deserts, but they form a priceless undeveloped part of the State, and, as such, have won the notice of many far-seeing and patriotic citizens.

The problem of arid farming in Utah is not new. As far back as 1847, in the time of the Mormon Voortrekkers, an attempt was made to utilise dry lands. Even at the building of the first canal, the pioneers wistfully put the question, "what can be done with the deserts?" To-day, after half-a-century of toil, the answer has come, and, with it, the first move in the Conquest of the desert. Since 1895, the reclamation of the deserts without irrigation has been the subject of much discussion amongst the officers of the Utah Experiment Station. In 1901, a systematic investigation was begun, and, in 1903 the Governor recommended in his message to the Legislature that arid experimental farms be established. Such is the history of the Arid Farm Bill.

In the State of Utah, five arid experimental farms have been established. They consist of 40 acres each. Each county in which a farm was placed donated the land, cleaned the farm of sage-bush, etc., gave it a first ploughing, and enclosed it with a rabbit-tight fence. Numerous citizens took a personal interest in the work and greatly simplified the inauguration of the experimental plots. These farms are under the direction of the Agricultural College. The money granted was $12,500 (£2,500) for five years, and the results are required to be published in bulletin form and in the daily Press of the country. It was Dr. Hilgard, of California, who first pointed out to us the wonderful depth, extraordinary uniformity, and inherent richness of the dry soils of the West, and certainly, in the case of Utah, we were reminded of the saying of Emerson, who writes, "The last lands are the best lands."

The Text of the Arid Farm Bill.

Experimental Farms on Arid Lands.

An Act establishing experimental farms to investigate and demonstrate the best methods of reclaiming the dry or arid or non-irrigated lands of the State of Utah and making appropriation therefor.

Be it Enacted by the Legislature of the State of Utah:

Section 1. Five experimental farms established. That, in order to investigate and demonstrate the conditions under which useful plants may be grown on the dry or arid or non-irrigated lands of the State of Utah, and to determine the kind of plants best

adapted for growth on these lands, there shall be established five experimental farms, or as many more as may be maintained by the appropriation designated in Section 7.

Section 2. Manner of conducting. That it shall be the duty of those having said experimental farms in charge to secure seeds from this and other countries of the world of plants that are thought suitable for growth on dry lands, and to observe and record the growth, yield, and composition of the plants grown from seed so secured; to investigate and determine the methods of soil treatment by which the soil water is best conserved; to investigate the possibilities of grazing on dry lands which have been seeded to different crops, and to undertake such other experiments and demonstrations as may be deemed advisable, having in view the reclamation of the dry or arid lands of the State.

Section 3. Only one in a county. How selected. That not more than one of said experimental farms shall be located in one county; that the said experimental farms shall be located in districts where there are large areas of dry land that may not in the near future be brought under irrigation; and that the locations of said experimental farms shall be selected under the direction of the board of trustees of the Agricultural College of Utah.

Section 4. Under direction of Agricultural College. That the actual work of experimentation and demonstration on said experimental farms shall be under the direction of the Agricultural Experiment Station of the State Agricultural College; that the officers of the said State Experiment Station, after having made selection of the locations of the said experimental farms, are hereby authorized and required to proceed to carry out the provisions of this Act.

Section 5. Annual report to be published. That the State Experiment Station shall prepare and publish, or cause to be prepared and published, full and complete annual reports of the work accomplished on said experimental farms; that an edition of not less than 6,000 copies shall be published annually and distributed free of charge to all State and county officials, newspapers and interested citizens.

Section 6. To be maintained five years. That these experimental farms shall be maintained for a period of not less than five years from the date of the passage of this Act.

Section 7. Appropriation. That for the purpose of carrying out the provisions of this Act the sum of twelve thousand five hundred dollars is hereby appropriated from any moneys in the State Treasury not otherwise appropriated, and the State Auditor shall draw his warrant on the State Treasurer upon request in writing by the Secretary of the Board of Trustees of the Agricultural College of Utah.

Plate CLIV. **Showing Centgener Plots of Wheat ready for Threshing.**

The grain is tied in bundles; the heads of the wheat being wrapped in muslin strips to prevent loss by shelling or from sparrows; and the bundles tied to stakes to dry.

Minnesota Experiment Station, College of Agriculture.

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Minnesota Experiment Station College of Agriculture

Plate CII

Breeding Hardy Fruits for the North-Western Prairies.

Professor N. E. Hansen, Horticulturist, South Dakota Agricultural College, crossing fruits under glass.

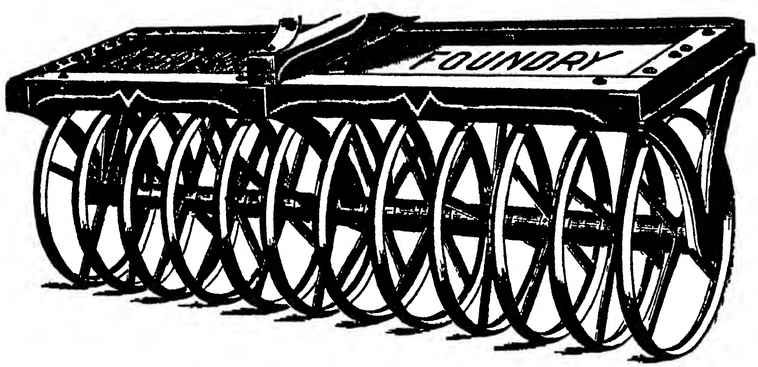
Section 8. County commissioners to provide site. Whenever the trustees of the Agricultural College desire to establish an experimental farm in any county, they shall, as a condition precedent, apply to the commissioners of such county to provide them with the gratuitous use of the required lands for the time needed, and upon the commissioners furnishing a requisite lease on suitable land, the said trustees may establish such farm.

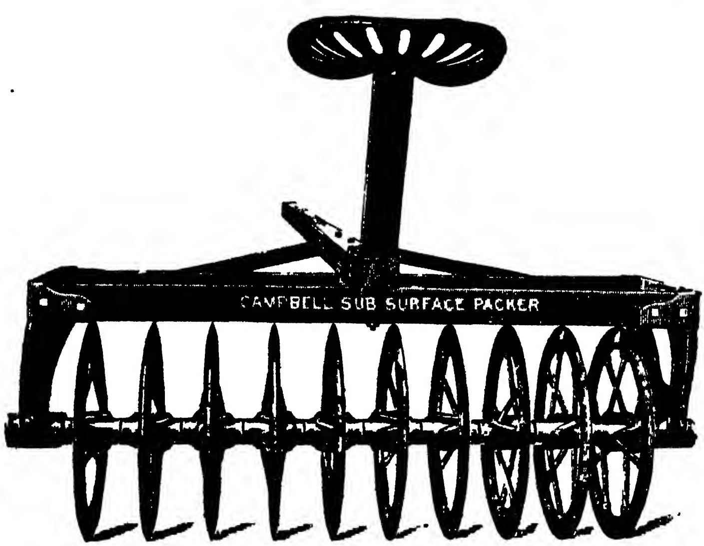
. . . .

Moreover, so far as drought-resistant cereals are concerned, the farmers of the West have been nobly aided by the magnificent work in plant breeding and plant acclimatization which is being carried on by the National Department of Agriculture, as well as by the various State Experiment Stations. In several of the Western States, notably in Kansas, Nebraska, Wyoming, Utah, Colorado, and Texas—more especially in districts where the rainfall is limited or irregular—crops are grown by what is widely known as the Campbell method. This system was inaugurated by Mr. W. H. Campbell, of Lincoln, Nebraska, and is intended to promote the conservation of soil moisture by special methods of tillage. Among the farming community of Western America you will hear many references to the Campbell system of cultivation. To our mind, Mr. Campbell stands in somewhat the same relation to Dry Land Farming that Mr. Luther Burbank does to Plant Breeding. And if Mr. Burbank has shown an astonished horticultural world his new creations, the result of countless crosses and tireless selection, Mr. Campbell has certainly produced surprising crops by deep ploughing and ceaseless cultivation; and although he may have added but little to the scientific knowledge of soil cultivation, he has assuredly drawn public attention in a remarkable manner to the need of intelligent and constant tillage in dry land farming. Further, he has given to the farmers of the West a new hope, and for this he deserves the highest credit. The journalist in search of sensational copy may hail dry land farming as his own special discovery, but the student of agriculture can hardly fail to trace the evolutionary chain of real advance down to the day when Jethro Tull, more than two centuries ago, penned the famous maxim, "Tillage is manure." Before giving a short account of this new practice, it may be well to describe Mr. Campbell's Sub-surface Packer, the only new machine used in arid farming. The Campbell Sub-surface Packer is manufactured by the Ottawa Foundry and Machine Company, of Ottawa, Illinois, U.S.A. This implement is designed to pack the sub-soil or root-bed for the purpose of increasing the water-holding capacity of the soil, promoting the upward flow of moisture, and, consequently, developing a larger root system. It should be noted particularly that the sub-soil, not the surface soil, is packed; thus the surface soil is left loose and forms a dust blanket or "mulch" which retards evaporation. This process of packing aids the growing crops to stand up during long periods of drought.

The machine consists of a series of V-shaped wheels 24 inches in diameter and 1½ inches apart at the rim. The wheels are loose on

the axle and turn around easily, breaking up the clods, and, at the same time, pressing the sub-soil. These sharp, wedge-faced wheels have both a downward and lateral pressure against the soil in the spaces between them. The soil is moved by the packer in such a manner as to form a firm and evenly packed stratum at the lower portion of the furrow. After the packer has been used, by employing the ordinary smoothing harrow or the so-called Acme harrow, the surface is pulverized and made fine, forming a perfect seed bed. Small clods are left on the surface which tend to hold the dust and prevent it from being blown away. The weight of a 6-foot pulverizer is about 900 lbs., and is all that one team of horses can conveniently pull.





The Campbell Sub-Surface Packer.

Used in Dry Land Farming in the West. By removing every other wheel and substituting a three-inch sleeve, it places the wheels four inches apart at the rim or six inches apart from centre to centre. Weight can be placed upon the platform sufficient to pack the desired depth. Manufactured by the Ottawa Foundry and Machine Company, Ottawa, Illinois, U.S.A.

The weight of the driver, together with some stones, will give any desired additional weight, while wheels can be replaced at the cost of about $1 each. We visited the factory at Topeka, Kansas, and were informed that the cost of an 8-foot machine was $45 (£9), f.o.b. Topeka. Mr. Campbell later informed us that he was placing the manufacture of his machine in the Ottawa Foundry and Machine Company, Ottawa, Illinois.

During our visit to the State Experiment Farm at Manhattan, Kansas, Mr. A. M. Ten Eyck, the Professor of Agronomy, kindly gave us his opinion of the Campbell System of Cultivation. Coming from one who is in close touch with the farming practice of the West, this statement cannot fail to be of interest.

The Campbell System of Soil Culture.

"The Campbell system of culture is theoretically correct, and, in part or in whole, it can be put into practice on almost every farm in Western Kansas. The system is intended to favour the conservation of soil moisture, and is thus especially adapted to regions where a limited or irregular rainfall makes the most careful methods of soil culture necessary in order to conserve the water in the soil and to get the most use from it in the production of crops.

"So far as cultivation is concerned, there are three principal steps in the conservation of soil moisture. First, the soil must be loosened to a considerable depth in order to prepare a reservoir to receive the rain and carry the water downward into the soil. This is accomplished in the Campbell system by the deep ploughing or by the discing of the unploughed lands. Secondly, the water which is carried downward into the sub-soil must be brought back again into the surface soil where the seed is germinating and the young roots are growing, and, to accomplish this, a good connection must be made between the furrow slice and the sub-soil below, and this is the purpose of the sub-surface packer. Thirdly, in order that the water which is drawn up again towards the surface may not reach the air and be wasted by evaporation, the upper two to four inches of the soil must be kept mellow in the form of a soil mulch, which is accomplished by frequent cultivation, and is applicable not only to corn, mealies and other crops ordinarily cultivated, but also to wheat and other small grain crops.

"Discing the land before ploughing puts the soil of the furrow slice in better condition to reunite with the sub-soil. The smooth hard furrow bottom left by the ordinary plough, however, is unfavourable to the proper union of the furrow slice with the sub-soil. To make the system perfect, I would add one more operation, namely, the bottom of the furrow should be scraped or loosened so that the union of the soil with the sub-soil may more quickly take place again after ploughing. The principles stated above have been known and practised more or less for a long time, but it remained for Mr. W.

H. Campbell, of Lincoln, Nebr., to arrange these principles together into a system of culture and put the system into practice throughout the Western States. Mr. Campbell has done more to call the attention of the farmers of the West to the necessity and advantage of good cultivation of the soil than any other investigator. The Campbell system of culture is, in fact, simply good tillage and good cultivation of the soil at the right time, in the right way, and in a systematic manner. Good farming pays in the West as well as in the East. I fully believe in the practicability of thorough tillage and good cultivation on every farm, and the increase in crops will more than pay for the extra work, and, in a series of years, will leave our farms in a better state of fertility and more capable of producing crops than will result from the careless and shiftless methods of farming which are yet too commonly practised by many farmers throughout the great West.

"It is not necessary to have extra machinery in order to successfully practise the Campbell system of culture. The only implement recommended which farmers do not generally have on their farms is the sub-surface packer. The use of the packer is most essential on late spring ploughing, when the purpose is to plant at once after ploughing. It is not so necessary to use the sub-surface packer on fall (autumn) ploughing, which is not intended to be planted until the following spring, but for the sowing of fall wheat, if the ploughing precede the sowing by a very short interval, the sub-surface packer may be used advantageously. Where the land is allowed to lie for a considerable period after ploughing before the crop is planted, the settling of the soil, together with the cementing due to the rain, usually causes the soil to re-pack and firm-up to a sufficient extent to make a good seed-bed.

"The sub-surface packer is a hard-running machine, and it costs much more to use than the common harrow or even the disc harrow. Thus, at the Kansas Experiment Station, we have adopted the practice of early ploughing whenever it can be done, in preference to sub-surface packing, using the harrow immediately after ploughing. The principle, however, in the use of the sub-surface packer is correct, and the lighter the soil and the greater its tendency to remain loose and mellow, the more necessary it is to make use of the sub-surface packer in order to prepare a proper seed-bed. Also, in the ploughing-under of trash or manure, sub-surface packing by pulverizing the bottom of the furrow slice sifts the soil through the coarse trash and causes a better union with the sub-soil below; so that the capillary water may be drawn up into the surface soil, whereas, if a heavy coat of stubble or manure ploughed under in this way is left without packing or pulverizing, the furrow slice is apt to dry out and the crop that is growing on the land may be injured by a short interval of dry weather.

"By setting the discs rather straight and weighting the harrow, a disc harrow may be used as a substitute for a sub-surface packer.

In mellow, trashy ground, its work is somewhat similar, resulting in a pulverizing and firming effect at the bottom of the furrow slice. Very often, however, good ploughing, with the proper use of the common harrow, may largely accomplish the results required in carrying out the Campbell system of culture.

"Some types of soil can be ploughed deeper than others, and, as a rule, I believe in deep ploughing at least every few years. The deeper loosening of the soil not only makes a larger reservoir to catch the rain, but it gives more room in which the soil bacteria may develop and prepare the plant-food. It is known now that certain bacteria in the soil have much to do with the preparation of the food for the plant, and experiments have shown that these bacteria are found largely in the surface six to nine inches of the soil, or in that part of the soil which is turned by the plough and stirred with the cultivator; thus deep ploughing favours the development of these bacteria and the preparation of more available plant-food than is the result from shallow ploughing. It may not be best to plough deep every year; sometimes shallow ploughing will doubtless give better results, and occasionally it is best not to plough at all. The depth and frequency of ploughing will vary according to the nature of the soil; a light or sandy soil requires less depth of ploughing and less frequent ploughing than a heavy compact, clayey or *gumbo* soil. This fact should be borne in mind, that when the land is ploughed deep it is necessary to re-establish the capillary connection of the soil with the sub-soil and prepare a good seed-bed condition by the methods described above in order that unfavourable results may not come from deeper ploughing.

"The principle of loosening the surface of the soil and keeping a mulch of mellow soil in order to break the capillary movement of water and prevent its evaporation is well recognised by farmers generally, and is practised to a greater or less extent in the cultivation of all kinds of crops. In the Campbell system of culture the purpose is to keep a mellow soil mulch on the surface of the land all the time, not only during the growing of the crop, but in the intervals between harvest and seeding time. Thus, after the crop is planted, the land is kept cultivated with the harrow or weeder in order to break the surface crust and conserve the soil moisture; and following out the same principle, the harrowing or work with the weeder is continued after the grain or corn is up, and during the growing period frequent cultivation is practised. After the crop is harvested the cultivation is not discontinued, but the surface of the ground is loosened as soon as possible after the crop is removed by the use of the disc harrow, and thus the soil is kept continually in a condition not only to prevent the loss of the water already stored in the soil, but this same condition and mellow surface favours the absorption of rain and largely prevents the loss of water by surface drainage.

"The weed harrow, or weeder, is probably better adapted for harrowing wheat or other small grain than the common straight tooth

or slanting tooth harrow. The weeder is somewhat objectionable on account of the wheels. When the ground is reasonably firm the common harrow may be used without injuring the wheat. I question whether it is necessary to continue the harrowing after the wheat covers the ground well unless very heavy rains firm and puddle the soil, destroying the mulch of mellow earth. Usually this will not occur. I have harrowed wheat when it stood five or six inches high and had stooled so as to about cover the ground, and the mulch thus produced was still in evidence at harvest time. In this experiment the ground was harrowed twice on the same day. The yield of wheat from the harrowed field was, on the average, three bushels per acre above that from the field adjacent, not harrowed. This experiment, with others, was carried on at the North Dakota Experiment Station with Spring wheat, and it was observed that wheat harrowed before it had stooled much was injured in stand and gave a lower yield of grain than wheat not harrowed. Wheat or other small grain may usually be harrowed without injury before it comes up, but after the grain is up it should not be harrowed until it has established a good root and made considerable top growth. It appears that even with winter wheat there may be some danger of injuring the wheat if harrowed too early in the spring, and I would not, as a rule, advise harrowing in the fall. Experiments in the harrowing of wheat and in the practice of the Campbell system of culture are being undertaken at the Kansas Fort Hays Branch Station, and also at the Kansas State Experiment Station at Manhattan."

In his *Manual of Soil Culture* Mr. Campbell writes in an interesting manner about summer cultivation for the conservation of moisture :

"In treating land as we would suggest we do not think the name 'summer fallow' applies. Term it summer culture. Beginning the work as early in the spring as the frost is sufficiently out of the ground and the surface dry enough to permit the use of the disc harrow without the soil adhering to the disc, going over the ground twice by lapping the disc one-half. This produces a mulch which prevents evaporation ; it also opens and loosens the surface, so that the later rains readily and quickly percolate into the soil ; harrow the ground after each subsequent rain. If the rain is too heavy so as to dissolve and pack the surface, a second discing may be necessary, especially if the season is advanced far enough for weeds to start freely. Don't, at all hazards, permit the weeds to grow, or the surface to become crusted, bearing in mind that our main object is to store the water in the soil below.

"Plough in June or early July seven to eight inches deep. Do not leave the field at noon until that which has been ploughed during the forenoon has been gone over with the sub-surface packer. Then at night the same, and if you use the packer, follow it with the Acme harrow at night, going over the entire day's ploughing. The common harrow produces very fair results or conditions, but the Acme will put

this ground in better condition than two or three times over with the common harrow. In June and July the weeds are quite persistent, and great care should be taken not to let them get the start. In fact there is but little danger of weeds if you take care to lose no water by evaporation. All weeds are easily killed when small, but after the top root has gone down and become firmly embedded, the harrow, even the Acme, is not sure to destroy them. Watch the condition of your field, going over it as soon after a heavy rain as the soil will permit, using the Acme if you have one, and set it out about two inches deep in the solid soil. This will make you a light loose mulch from two-and-a-half to three inches deep. Continue this persistent care through the season; in case of extreme heat more frequent cultivation is necessary. Our rule is to watch carefully the firm soil just beneath the mulch, and gauge our time of cultivation during continued dry periods by the quantity of apparent moisture observed at the top of the firm soil beneath the mulch, or if we move the loose soil away and find there is ample moisture, the protection is all right. If the top is beginning to show dry then it is time to cultivate again.

"Remember it is not the object of summer culture to give the land a rest, but rather the reverse. The object is to keep the land alive and actively engaged in the manufacture of plant foods to improve the physical conditions of the soil by every part of the work done, either directly or indirectly.

"By holding the moisture near the surface during the heated portions of the season we succeed in securing a more complete decomposition of the vegetable matter in our soil, passing it on to the stage that is known as humus, which is a most valuable element in the soil. The more humus we have the greater amount of moisture we can hold in the ground. This, coupled with the amount of moisture that we are able to store, and the improvement of the physical condition of the soil by discing, ploughing, and frequent cultivation in our summer culture, brings about three conditions. First, our soil will hold more water, consequently our plant is less liable to suffer from the lack of water during extreme heat. Secondly, this packed condition from the fact of the more minute pores in the soil is also favourable to a more rapid movement of moisture by capillary attraction; and lastly, but not least, conducive to a more prolific growth and uniform distribution of the roots.

"Do not confound summer culture with summer fallowing. They are different. Summer culture for the storing of the rain waters in the soil, although comparatively new as outlined above, is a most important adjunct in farming in the West. Begin your summer culture as early in the spring as conditions will let you on the ground with your disc harrow. Don't let the weeds grow, thinking they are valuable as a fertilizer to turn under. The moisture they take from the ground is worth far more to the improvement of your next crop.

"It follows then that the greater amount of water we can store in the soil previous to the planting of the crops as well as during their

growth, and the greater care we use in the cultivation of the surface of the ground, so as to retain and economise the moisture so conserved, the greater must be the yield at harvest time. In connection with this fact there is another of no less importance, viz. : the physical condition of the soil. The ground should be prepared as perfectly as possible to insure a prolific growth of roots. That the vast prairies of the semi-arid belt are simply of use as the grazing grounds for a few scattered herds is no longer held to be practical ; now we see the vision of vast numbers of smaller herds of flocks and thousands of prosperous homes and flourishing towns—the fertile centres of numerous farming communities."

Speaking of the proper depth of ploughing, Mr. Campbell remarks:—" The proper depth of ploughing must be governed very largely by the condition of the soil, the time of year when the ploughing is done, the time it is to be seeded or planted and the kind of tools you have for the after work.

" Take the average prairie soil, especially if it level with a sand loam formation : I advise ploughing fully seven inches deep if to be seeded or planted soon after. In case of early fall (autumn) ploughing for spring crops and moist soil, if you have sufficient team it will be found profitable to plough eight inches deep, following with packer and harrow. If you have no packer, I would not advise ploughing over five inches deep, using the common harrow with the teeth slightly slanting and weighted, the object being to pulverize and firm the under portion of the furrow. Much care and attention should be given to the furrow slices that they may be even in width and depth so that when you go over the ground with your packer or harrow there may be no soil spaces left loose and porous. The average farmer must realise the great importance of thoroughly fining and firming the entire ploughed portion. In the ordinary conditions, as found at the bottom of furrows in ploughing left without any further work until it has all dried out, fully one-third of the soil constitutes no nourishment whatever to the growth or production of the crop. By adding a little extra pains and labour that one-third of non-productive soil may be put in condition to do its full share in making a larger and better crop. By closely following this rule you will greatly increase the quantity and quality of your crops of small grain."

Nebraska.

Mr. Montgomery, Assistant Professor in Agronomy in the State Agricultural College at Lincoln, kindly gave us the following information regarding dry-land farming in Nebraska.

" There is a considerable difference in the rainfall in this State. In the western portion of the State we only get on an average 14 inches ; but in the East, along the Missouri River, we get from 30 to 35 inches per annum ; and the average decrease is 5 inches for every 100 miles as you go West. In the extreme West we find the sage brush and the buffalo grass country. We term two-thirds of the State

Plate CLVI **American Students Judging Maize (Mealies).**

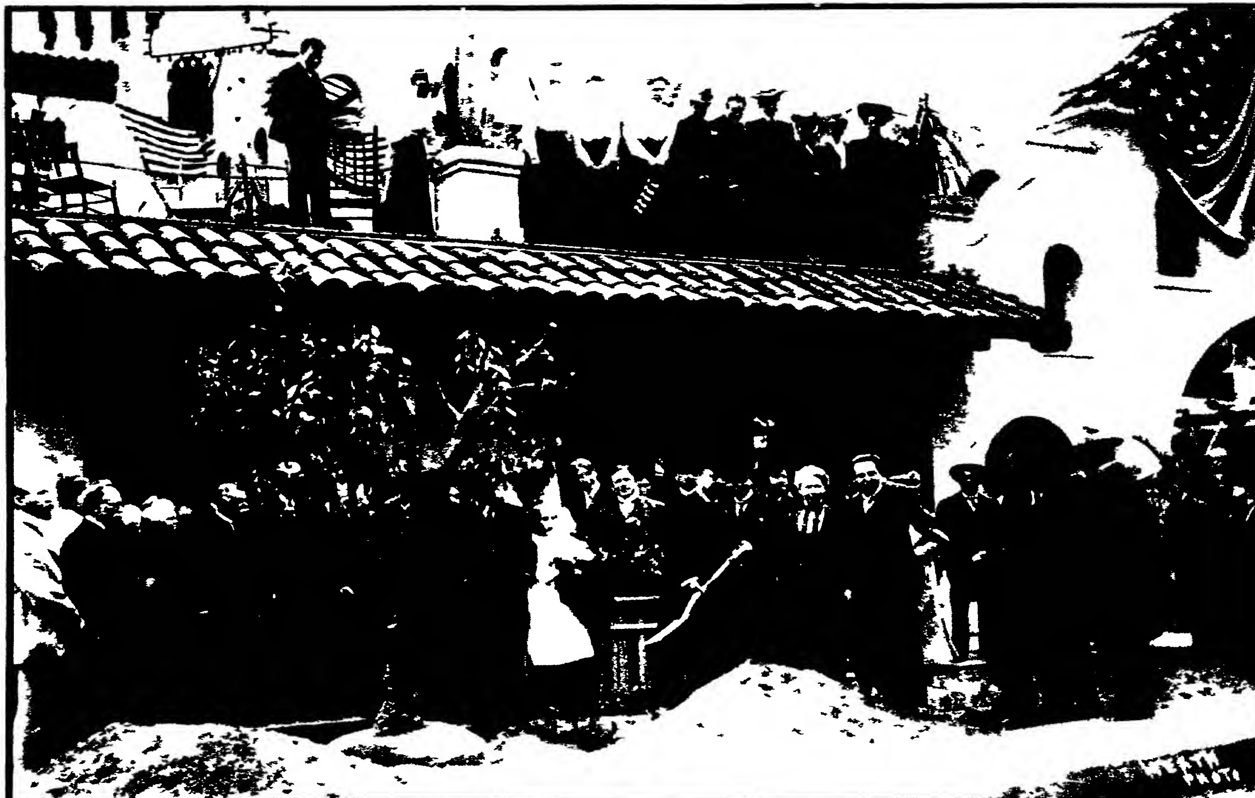


Plate CLVII

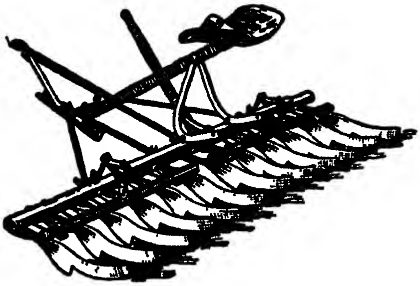
President Roosevelt replanting the original Navel Orange Tree at Riverside, California.

The parent tree of the Navel Orange industry of America.

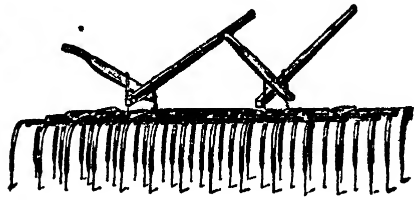
Plate CLVIII. **Dry Land Farming on the Wyoming Prairie.**

A Field of Potatoes at Cheyenne Showing the result of deep ploughing and constant cultivation.

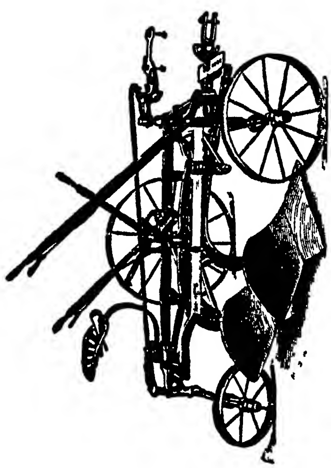
a dry farming country, whilst one-third in the East is humid. The whole of the North Central portion is composed of sand-hills with nutritious grasses—such as blue stem grasses and wheat grasses.



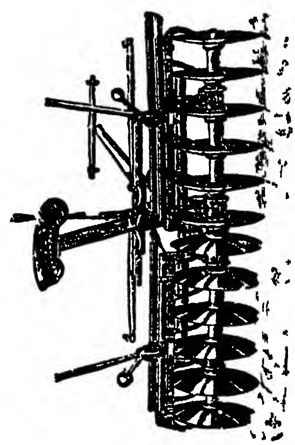
The Acme Harrow.



The Weeder.



The Gang Plow.



The Disc Harrow.

Implements used in Arid Farming

"The third band of settlers is now in Nebraska. Many who moved out during the periods of drought are now returning. The reasons for the first failures are not far to seek. The pioneers tried to grow crops that were not adapted to this western country—seed grown in the humid regions, such as corn (mealies), grasses, and small grains.

"The biggest problem before our experiment stations is how to grow crops adapted to these regions. The first drought resistant crop introduced was lucerne (alfalfa). All river valleys have an underground water supply, and we can raise an unlimited amount of alfalfa without irrigation. It is even grown upon our uplands. Practically no irrigation is used in growing lucerne in Nebraska ; and at present we have half-a-million acres under this crop, and it is spreading very rapidly throughout the State.

"Sometime ago the Department at Washington sent out agricultural explorers to the dry regions all over Europe. Grains were imported chiefly from Russia and North Africa; one of the earliest importations was the grass *Bromus inermis* which is grown in Russia with a rainfall of from 12 to 20 inches. It produces a large amount of seed, and is easily cultivated. In 1896 we sent packets of seed to 350 of our farmers. It promises to be a most important factor in our agriculture, and produces twice as much hay as our native grasses, which do not produce seed in any quantity, and so we cannot re-seed easily. For annuals we grow canes (sorghum) and Kaffir corn. They have proved a great boon to the West. They have kept the cattle in condition over the dry winter months. They were introduced about 1892, and satisfied us so far as forage was concerned; but we have always wished to grow grain crops.

"Two problems before the Western farmer are first, to get crops adapted to dry lands, and secondly, to conserve, as far as possible, all the moisture that falls. To get these crops agricultural explorers travelled all over Russia and Australia and collected any likely grains. This station brought in the Kherson oat in 1896 from the Province of Kherson, in the Black Sea district, where the rainfall is about 20 inches. We grew it here, and distributed it throughout the State. This variety far outyielded the native varieties. The next introduction of importance was the Durum wheats; about 25 different varieties were brought into the State and tested here. They come from Southern Russia, from a region having from 10 to 20 inches of rainfall. In fact it may be said that these wheats won't succeed in a part of the State having more than 20 inches of rain. In Davies County Mr. F. W. Coil, one of our farmers, has been growing this wheat for the past 5 years, and has averaged over 30 bushels to the acre. The rainfall in his region is about 18 inches.

"In the semi-arid part of Nebraska some 12,000,000 acres will be available for growing macaroni wheats which are spring wheats; now before the advent of these wheats we could not grow wheat outside the river valleys. Another wheat that has given good results is the Turkish red winter wheat from the Crimea in Southern Russia. It is a winter wheat. In its home in Russia the rainfall is from 20 to 30 inches. It has proved very drought resistant, much more so than the older varieties of winter wheat. We are also looking out for drought resisting varieties of barley. Here in the West we have a great deal of level land, and a large amount of sandy porous open soil. The land will absorb almost all the water that falls upon it in our ordinary rains. Thus 20 inches may be quite sufficient, and of far more value to us than 40 inches in Pennyslvania, where the land may be hilly or composed of clay soils, as in that case a large percentage will simply run off and be wasted. Then we have hot drying winds in July and August, and so our plan is to keep the surface continually cultivated from the time the frost goes out of the ground in the spring until the land freezes up next winter in order to prevent the rapid evaporation of moisture.

"Of late we are adopting the principle advocated by Mr. Campbell, viz. to put two years' water into one year's crop. Out here land is cheap from $3 (12s.) to $5 (£1) per acre, and it is easy for a farmer to keep one portion of his ploughed land as a summer moisture saving fallow—cultivating all spring and summer without a crop, and planting next autumn or spring. Under the common system of farming the ground would be so dry in the fall that a crop would not germinate.

"A great part of our lands in Nebraska is level, and can be easily and cheaply worked with big harrows taking 3 feet at a stretch. With drought resisting crops and the new system of moisture fallows there is a very bright future for the arid lands of this State. My only fear is that many of the farmers may not take to the Campbell system owing to the amount of work which it involves. In some cases the saving of moisture runs out at $10 (£2) per acre, and the average wheat crop brings in only at the rate of $8 to $10 ; but with potatoes, say at $40 (£8) to $50 (£10) per acre, it is a different matter. The Campbell system is well adapted to the potato and sugar beet ; but it may not always prove profitable with grain crops. The principles Campbell advocates are sound, it is only a question of how far it may be profitable to apply them. Much labour is necessary to keep the ground constantly stirred by Campbell's method. It might prove too expensive seeing that we have to compete with the growers in the humid regions of the Mississippi Valley. But it is certainly the only hope for redeeming the whole of the Western Country.

"At the North Platte Experiment Station we have 2,000 acres ; 240 under irrigation, all the rest under dry land farming methods. We are testing new varieties of wheat, oats and barley, and a large number of different methods of cultivation : also some 400 kinds of forage crops, 300 varieties of wheat, 50 of oats and corn (mealies), and tests with numerous machines specially adapted for the new systems of improved tillage."

Wyoming.

It was interesting to meet Dr. Elwell Mead, Chief of the Irrigation and Drainage Investigation Division, in the National Department of Agriculture, and to find that he too was an enthusiastic exponent of dry land farming. Dr. Mead has lived in Cheyenne for over eleven years, and frankly stated that, until a short time back he had no idea that crops would ever be raised in the semi-arid regions without irrigation. He advocates, however, a wise compromise between the extremists of both gospels ; that is to say, he believes that every dry land farm should possess, if at all possible, five acres under water by means of pump and windmill, so that the farmer, in a year of partial failure, would not have to borrow money to buy his immediate necessities, but could fall back upon a little grain, fruit, vegetables, and lucerne. A little while ago there was hardly a cultivated field within sight of Cheyenne, and not a harvester nearer than 35 miles ; but already Dr. Mead and his assistants are creating a new order of things. When they first began to plow the rain only went down 12

inches below the surface. There it was as hard as a brick-yard, and you could hear a spade ring all down that depth. Deep and continuous cultivation, without a crop was followed ; and this year the ground is moist down to a depth of 3 feet, and the rain sinks in instead of running to waste, and 75 acres are ready for planting. The tests in this part of Wyoming will consist of deep cultivation, summer fallowing for conserving moisture, and the keeping of a perfect soil mulch for at least two years. (See Plate CLVIII.)

Of the seventy acres on the Government Farm, five acres are irrigated by windmills, thirty-five without any irrigation whatever and the remaining thirty acres are winter irrigated. This farm when it was turned over to the Government in April, 1905, for experiment work was, with the exception of a very small patch, in virgin prairie, and required a great deal of work to put into proper shape for the seed; consequently no crops were planted until fall, when some winter crops were sown. The crops chosen for the experiments are wheat, rye, alfalfa, field peas and potatoes. Each of these is now being cultivated in three divisions of the farm, and show every evidence of producing excellent crops, although it is still too early to determine just what each division of the farm will bring, the results have thus far been highly satisfactory. The experiments will continue through the five years, and during that time it is confidently expected that many of the problems of farming on the arid plains of Wyoming will be to a large extent solved.

Board of Trade Experiments.

Seeing that the Department of Agriculture had undertaken the work of scientific experiment, the Board of Trade Committee applied its efforts to awakening among the ranchmen in various parts of the country an interest in dry farming for the cultivation of crops on the prairies.

The city of Cheyenne, the County Commissioners and the Board of Trade contributed in all one thousand dollars for the purpose of encouraging dry farming experiments among the ranchmen.

Members of the Committee were attracted to Oregon, where for a number of years there had been experiments looking to the raising of various crops of wheat and forage plants for the reclamation of the lands in that state which had previously been considered arid.

The average rainfall in Wyoming every year is over thirteen inches, and for the past ten years has averaged between 15 and 16 inches, and it is conceded that this is ample for the successful harvesting of such crops as have been grown in the vicinity of Cheyenne this year.

The experts at the Government Farm, however, are going into the experiments thoroughly, and in undertaking to continue the experiment farm for a period of five years expect that the severest test of the dry farming system will come in years when the annual rainfall is below normal. Records of the weather bureau show that during several seasons in the past thirty years the annual rainfall did not exceed nine inches.

Doubt has been expressed whether in such dry years a farmer on the semi-arid plains could succeed, and the experiment farm by careful measurements of rainfall and the proportion conserved in the ground, proposes to ascertain by actual experiment the minimum amount of moisture upon which the farmer may safely depend.

It is for this reason that the Irrigation Bureau has erected windmills and constructed reservoirs in order to demonstrate to every farmer who settles on the plains the desirability of having a source, even if small, of supplemental water whereby he may save his crop by irrigation in time of need.

The minimum amount of moisture that has fallen in Wyoming in any one year for the past thirty years is about nine inches, and if this is sufficient to raise a crop the future of dry farming for the reclamation of the semi-arid plains is assured.

The claim is made that this amount is sufficient and is supported by the Department of Agriculture Year Book for 1900, which says: "In the Palouse region of Washington and Idaho twelve inches yearly rainfall is usually considered sufficient for a good crop of wheat. In that part of Oregon, near the Dalles, the average yield of wheat without irrigation, according to the Vice-Director of the Oregon Agricultural Experiment Station, was in 1900 twenty-five to forty-four bushels per acre. The rainfall of Moro in that district during the year from November 1, 1897, to November 1, 1898, was 8.64 inches." In addition to this, in Oregon the moisture nearly all comes in the winter, while in Wyoming there are frequent summer showers which come when they are most needed by the growing crop.

Under the approved methods of dry farming, however, a crop on a piece of land *every other year* is all that is looked for, the farmer keeping half of his acreage in crop and the other half cultivated to conserve the moisture so that the rainfall for two years is given to every crop grown.

If this practice is carefully followed with strict attention to the fallowing of the idle soil, the farmer takes practically no chance of a failure. In years of unusual moisture he may indeed get two crops in two years, but if he satisfies himself with one crop, that crop in wet years will probably be a bumper, and in average years will be a success where possibly his more venturesome or impatient neighbour may fail.

Brief mention should be made of the tremendous increase in the value of the lands in the vicinity of Cheyenne through their cultivation by dry farming.

The Salem Colony.

Salem is in the extreme eastern part of the county and is the centre of a thrifty colony of Swedish ranchmen. Like practically all of their neighbours, the Salem people make good use of the range for their cattle and sheep, but their thrifty nature led them many years

ago to try to compel the unwilling soil to give forth more than prairie grass. Though they met with repeated discouragement, their livestock enabled them to hold on when their contemporaries in Nebraska, Kansas and Colorado, who sought to bring the rain belt westward with them, were driven back after a few disastrous seasons.

Their Scandinavian determination held them to farming in spite of the fact that other ranchmen had long ago given it up except for the cultivation of hay along some friendly stream, and eventually the Salem people began to reap the reward of their persistence. They are a peaceful, quiet, almost clannish people, and being out of the beaten track few strangers visit them, but those who do find waving fields of grain, rich purple alfalfa, while the few Salem potatoes that get into the open market are quickly snapped up.

"The average ranchman," so runs the legend, "wants to farm on horseback," but the Salem ranchman would not take "no" for an answer, and practically compelled the earth to give him his crop. They had no scientific knowledge of dry farming, yet they succeeded, and their success is being regarded in a new light since the gospel of dry farming was preached in and around Cheyenne. Like the people of all ages the dry farming prophets were met with the cry, "Give us a sign." And the sign came out of Salem. The men of the Swedish settlement, struggling blindly for agricultural success in a semi-arid plain, have by the strength of their arms established the corner upon which is the confidence in the new preaching of dry farming.

The people of Salem are learning the new method now along with the rest of the West, but they demonstrated first of all that a poor man could live happily and thrive on the fruits of the earth raised by his hand on the lands which all others thought fit only for sheep or cattle ranges.

California.

During our visit to California we had the pleasure of meeting Dr. Hilgard, the eminent agricultural chemist.

In speaking of dry farming Professor Hilgard remarked that as a general rule soils ought not to be too heavy. Clay soils are unsuitable as it is impossible to get them to bring up the moisture to the plant fast enough. Further, such soils prevent the penetration of the roots of the plant, and are therefore to be avoided. He also emphasized the fact that the depth of the soil is a most important point. Whenever that can be secured the possibility of farming on dry lands is reasonably safe. Broadly speaking, sandy or silty soils or sandy loams are best adapted to dry farming. Dr. Hilgard remarked that he understood that the soils of the South African veld were more or less of this character, and consequently, should be suited to dry farming.

Soils containing a large percentage of humus have a great advantage over those which are lacking in this quality. At the same time it is sometimes erroneously supposed that the humus is always

found at the surface in soils of the arid regions. Dr. Hilgard has found humus down as far as 12 feet in soils, and more or less evenly distributed to that depth. Although arid soils are usually comparatively poor in humus, that humus is from 3 to 4 times richer in nitrogen than that of the humid regions and smaller amounts of that constituent suffice for the needful nitrogen supply. Soils poor in lime are to be avoided ; or must be limed with marl or quicklime, preferably with marl.

A word as to the land in general which may be deemed suitable to dry farming. A gentle slope is the best, since hilly land is liable to be more irregular, and there are often faults in the soil strata ; moreover, the farmer can never be sure what he has got in hilly country.

Again, vegetation is all-important. As a general rule the farmer should first look out for wild leguminous plants (pod forming plants). For two reasons : firstly, because they indicate the presence of sufficient lime to justify dry farming ; and secondly, they nearly all have deep roots showing a good depth of soil permitting penetrability. Another point to be noted on viewing all agricultural lands is the development of trees. Are they well developed and of fairly normal form—not low or stunted? It is not so much a question of species as a problem of normal or abnormal growth. Certain trees indicate good land provided they are of normal growth.

Another point is to bore to a depth of not less than 5 or 6 feet in order to see what sort of subsoil there is. In dry farming the amount of moisture which will rise to the plant roots depends upon what sort of soil is below the surface and its depth. Gravel will effectually hinder water from getting up from below. If the water table (viz. the point at which water is found by digging) is too shallow the roots will be prevented from feeding properly and may be drowned. For example a water table of 5 feet is too little for lucerne, although it would do well enough for clover ; lucerne should have at least from 10 to 15 feet in which to develop.

In case of doubt as to the real nature of the land you can go to the nearest spruit or bluff and look at the geological formation. Again, you can often get a good idea of the true nature of the subsoil by noticing how deep ants and other burrowing animals go, and what kind of soil they bring up.

Perhaps a simple case will make this clear. Some time ago in the State of Washington in a particularly arid rolling district Dr. Hilgard noticed a tall luscious grass in moist low grounds. He could not understand how the grass happened to thrive there until he observed that it invariably grew in the burrows of badgers. The badgers had subsoiled the land which was then moist enough for that particular species of grass. Here the badgers proved a true beacon to the farmers who went in and possessed the land. Subsequently the same land grew excellent crops of potatoes. It is always well to look carefully at the roots of the grasses ; to follow their depth and then to find out by

practice, analysis, or enquiry the nutritive value of each grass. Some grasses are so full of flinty matter that cattle will not thrive on them ; others again, growing on very dry lands, often prove excellent feed.

Animals often prefer grass growing on hilly lands to the green vegetation on low lands which is apt to be more or less salty, especially in the arid regions.

Now as regards the crops suitable to dry land farming. Oats, rye and barley, in the order named, may be considered the most drought-resisting of our crops. Oats are the most drought-resisting of all the cereals, and will grow on extraordinary dry lands. It is true that on dry lands they fruit low—the stems being often very short—but they produce plenty of seed, even on heavy clay sunbaked soil. Indeed we have found barley roots growing down along the walls of sun-cracks in clay soils and yet fruiting abundantly. Maize (mealies) is also a good dry land crop, and may be sown after the summer rains have passed and used as green feed.

For the encouragement of South African farmers we may mention that in California a great reputation has been won in fruit growing in some of the more important valleys where the rainfall is not above 15 inches per annum. For example, it is only yesterday that irrigation was introduced into the great Sacramento and Santa Clara valleys ; yet long before that time splendid crops had been raised by dry farming. In this matter the State of California may justly claim to be the pioneer. For many years it was not believed that anything could be grown without irrigation. Men do not yet understand the great depth of soil in the dry regions ; nor do they realise that Providence has provided arid countries with an almost inexhaustible fertility. But such is the lesson of History. The oldest civilizations have been developed in arid regions. Dry land farming has been practised since the dawn of civilization in Mesopotamia, in Egypt, and North Western India. Nor can it be doubted that the great depth of arid soils which gives from three to five times the amount of soil in the same area as in humid climates is one of the prime causes which enabled the ancient agriculturists to remain in the same country and for such measureless periods without being acquainted with our modern methods of soil improvement. It is notorious that the roots of plants are found to penetrate in dry regions to a much greater depth than they do in humid regions. And if the roots can penetrate so surely must both water and air.

Moreover, in dry lands the formation of clay goes on very slowly : furthermore, the rains do not carry the clay into the subsoil as in humid climates, and so the soil remains loose. Again, in humid regions all subsoils are more clayey than the surface soil ; whereas in dry climates there is no subsoil in the ordinary sense of the word. It is simply all soil clear down. It is true that in arid regions clays may be found in low lying ground ; but that is mostly a more or less local problem and may be traced to some recent geological formation or to

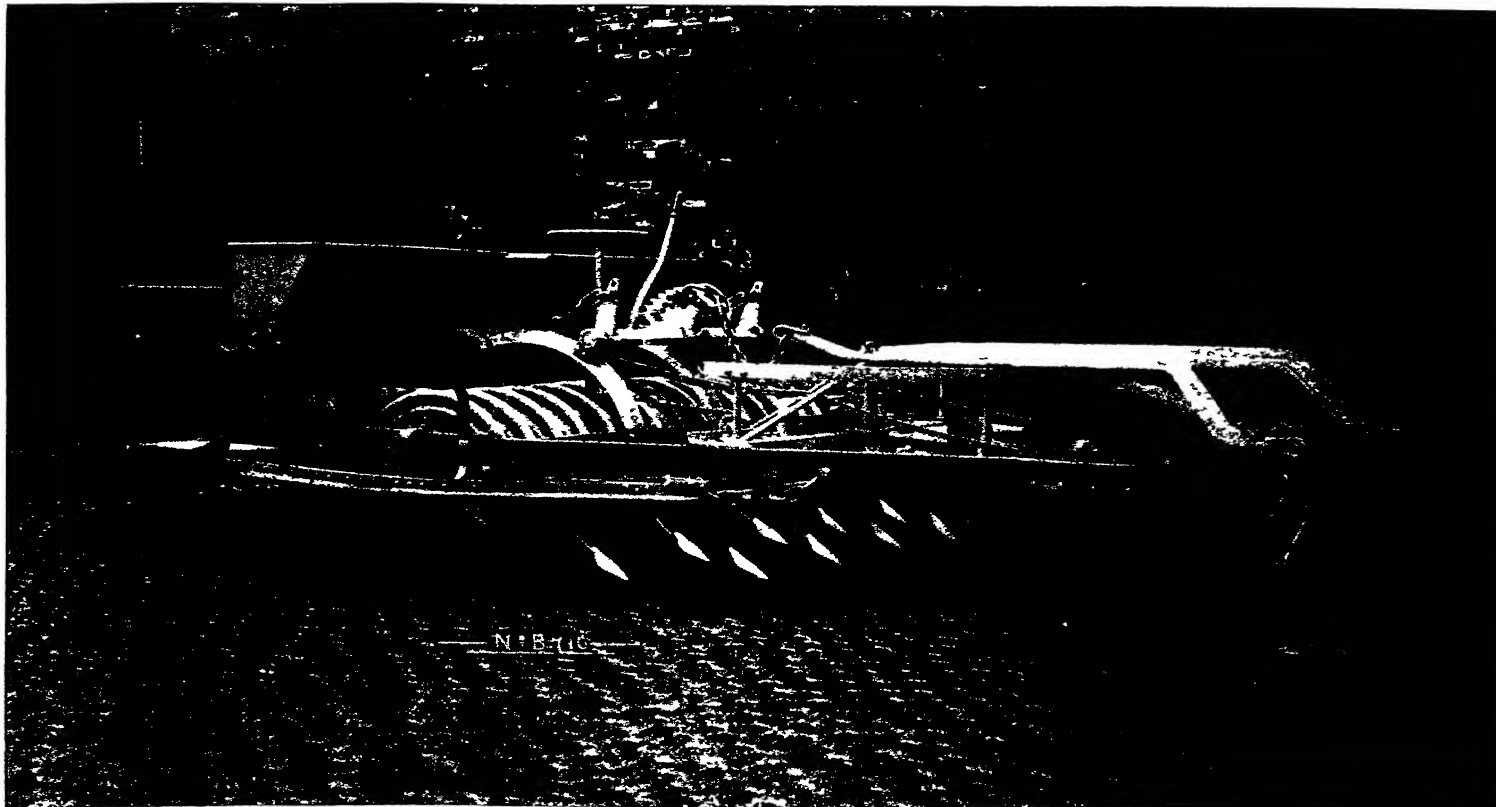


Plate CLIX. **The Fowler Sub-Surface Packer.**

Used in the reclamation of arid lands. Showing cultivator, packer (consolidator), sower, and harrows. This combined machine will plant 45 acres per day, and weighs about five tons. (Manufactured by Messrs. John Fowler & Co., Leeds, Eng.)

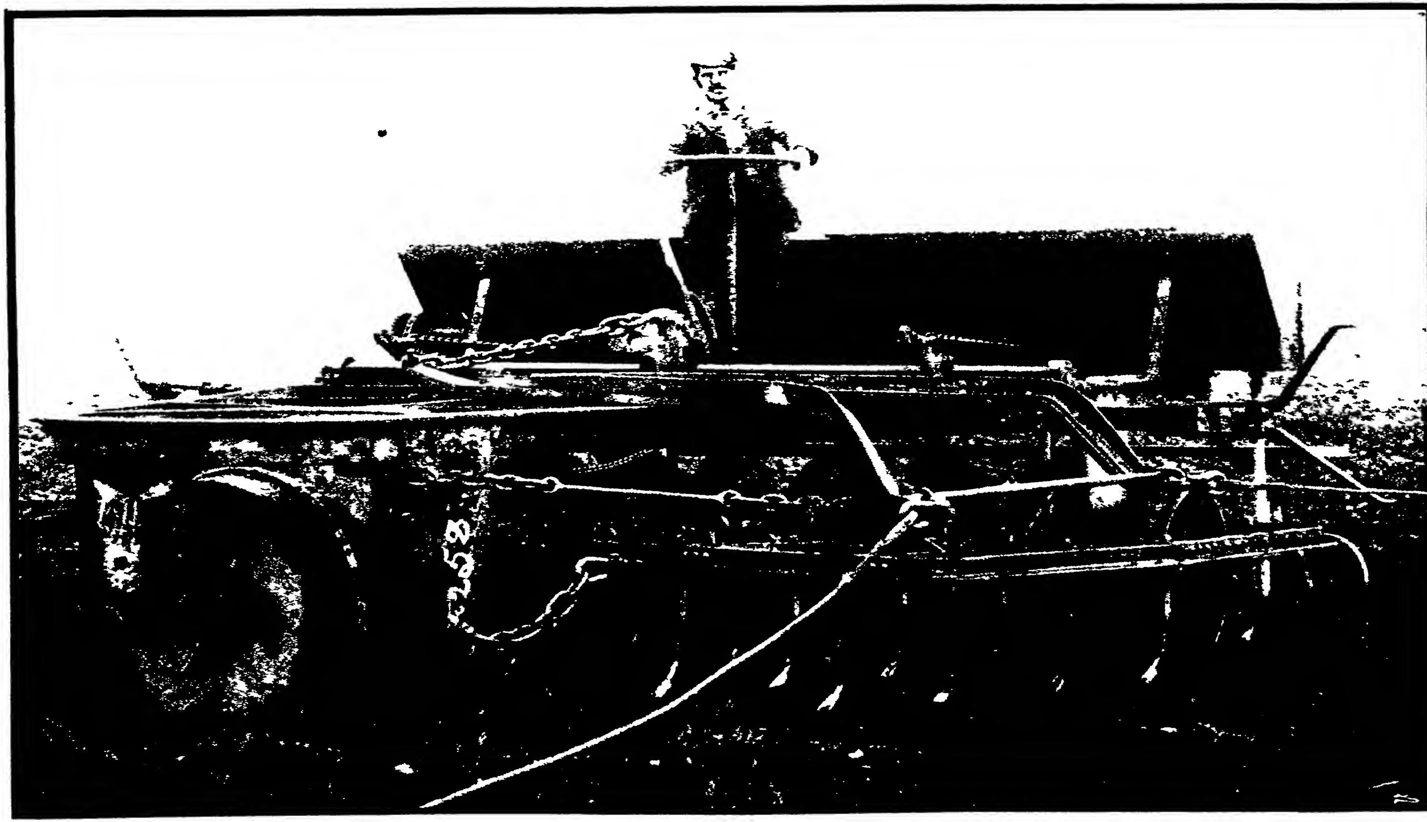


Plate CLX.

The Fowler Sub-Surface Packer or Consolidator.

Automatic Lifting and Turning Gear.

By means of this ingenious device the whole machine is lifted clear out of the ground and let down again at the will of the steersman.

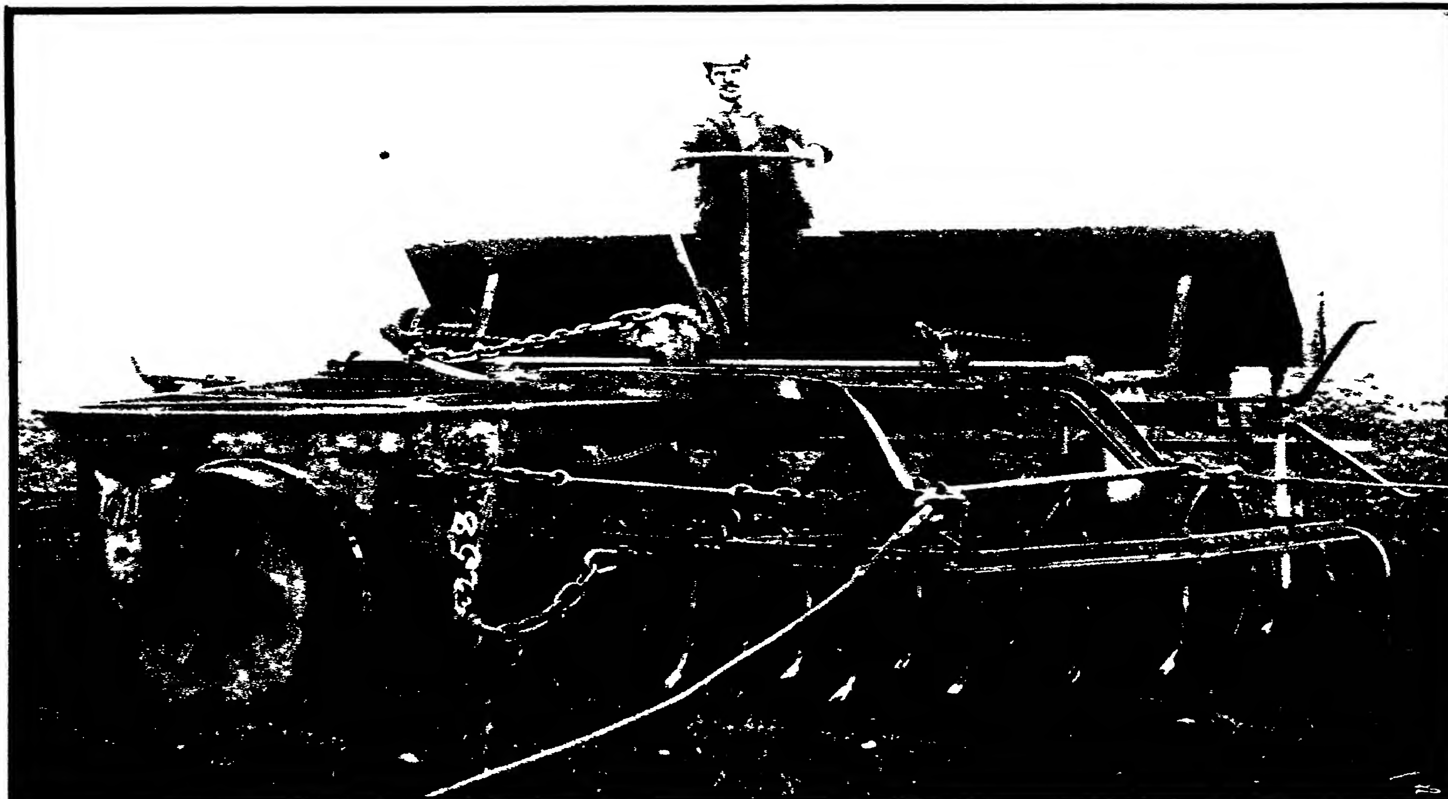


Plate CLX

The Fowler Sub-Surface Packer or Consolidator.

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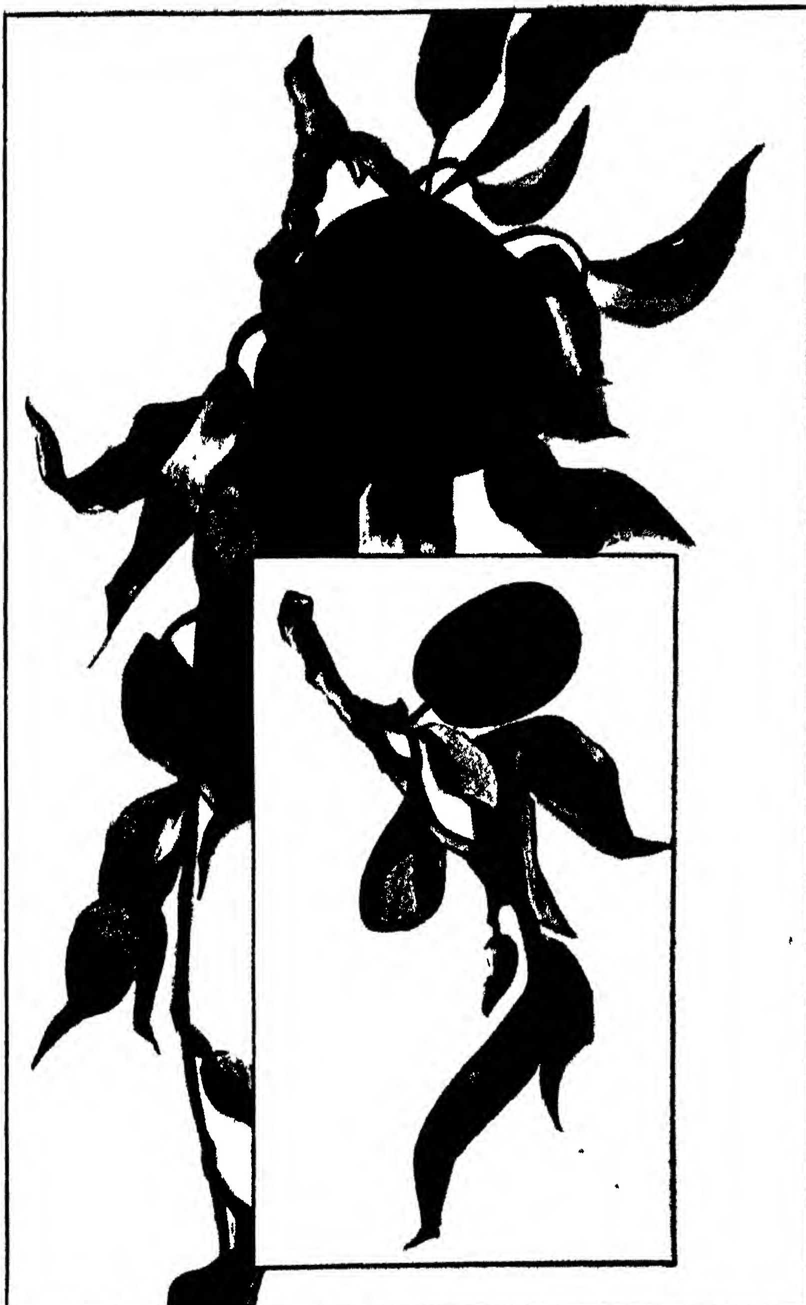


The Stoneless Hybrid Plum and **The Plumcot**, a cross between the Plum and the Apricot.
Originated by Luther Burbank, Santa Rosa, California.

Plate CLXI.

[**Reduced two-thirds natural size.**

the expansion of swamp clays. The reason of the greater depth and uniformity of arid soils over humid soils is the small amount of plastic clay formed in weathering and the absence of the washing down of clay particles by heavy rains.

In dry farming an accurate knowledge of the annual rainfall is, of course, essential. In the Santa Clara Valley 15 inches of rain annually produced the finest fruits of dry farming, including such fruits as grapes, prunes and apricots. It may be said that it is possible to farm with 12 inches and even less, provided the entire rainfall is absorbed in the soil by keeping the surface loose and then conserved by making a loose mulch ; but, ordinarily, under 15 inches, irrigation is needed to be certain of a crop. That is to say, in the Sacramento Valley, with from 15 to 20 inches of annual rainfall, dry farming has been eminently successful.

In California the last rains come in March and April, and then dry weather for about 6 months. Sowing takes place from November to March. The season of our rains determines whether we shall reap our cereals for grain crops or cut them green for hay. With plenty of rain we harvest the grain ; with scanty rain we turn the crops into hay. In dry farming the distribution of the rainfall is extremely important, and much more so than the total amount which tells only half the story.

For example, in some Provinces of India and in the State of Montana there is as much as 24 inches of rain every year, distributed over the whole season. Yet there is drought ; and in India often famine. Thus the whole problem resolves itself round the question : What is the amount of rain which falls during the growing season of the crop? In the Sacramento and Santa Clara Valleys the whole 15 inches falls within the growing season, viz., from November until April, and during the next six months of the year practically nothing falls. In Montana there is 24 inches of rain ; but during the growing season only about 10 inches falls, which is not enough ; and hence irrigation becomes necessary.

The Transvaal.

On our return from America and in company with Mr. W. A. McLaren, the representative of Messrs John Fowler & Co., Leeds, we travelled to Vereeniging for the purpose of seeing the Fowler packer or consolidator at work. Mr. McLaren is an enthusiastic advocate of the gospel of deep ploughing and constant cultivation, and his paper in the "Agricultural Journal" on "Steam Ploughing" (Vol. iv., No. 14) will be remembered by our readers (Plates CLIX. and CLX.)

The Vereeniging Estate, consisting of about 100,000 acres, belongs to the well-known firm of Messrs. Lewis and Marks, and about 2 years ago a large area—comprising the farms of Vyffontein, Leeuwkuil and Klipfontein—was turned over to Mr. McLaren to be placed under cultivation by means of the steam plough.

The ploughing tackle at Vereeniging comprises four engines, various ploughs, harrows, cultivators, etc., and of special interest two packers or consolidators, grubbers and seeders. The engines employed are of the stationary type having a long steel cable stretched across the field by means of which the ploughing, harrowing and compressing machines are pulled to and fro across the lands. The advantage of this system over that of the direct traction engines is now too well known to need any further mention. These engines at Vereeniging have been employed for all farm operations, and during practically every day of the year. For the sake of convenience the lands are laid out in 31-acre fields; this being the approximate length of the steel cable. Some 2,700 acres are now being planted, mostly to mealies.

The method of fitting the virgin veld is as follows: Firstly, the land is ploughed deeply, about 10 to 12 inches, and then the consolidator is applied. This implement weighs from 5 to 6 tons, and consists of a 24 tine grubber set to run to about 8 inches deep. Just behind the grubber comes the sub-surface packer or consolidator, consisting of 18 or more cast iron wheels loose on a spindle. The wheels are about 3 feet in diameter and are placed 9 inches apart. Each wheel is rounded on the rim—and in section is rather like a railway rail. This heavy implement going over the ground packs the subsoil very firmly, and as the rings rise out of the ground they lift a little of the loosened soil which the harrow, attached behind, scatters and levels, leaving a nice loose mulch on the surface. This combined machine weighs 5 tons and can grub, pack, plant and harrow 60 acres per day.

A single treatment of the packer is usually sufficient; but on very raw or dirty lands a second ploughing and consolidation is given. The tilth resulting from a double consolidation is certainly as fine as can be seen in any part of the world; and is a striking demonstration of the wonderful way in which lands in this Colony respond to the best tillage.

Virgin veld when newly turned over naturally seems rather refractory, but proper cultivation, even in a single season, produces an entirely altered tilth, and instead of a harsh raw ground we find a kindly loam. The trouble with a great number of lands laid down to mealies in the Transvaal is that one ploughing is usually thought enough; with such careless fitting it is no wonder that these fields are the first to suffer from drought. Mr. McLaren fears no drought because his lands are deeply ploughed, packed and constantly stirred.

In a country like South Africa, with its periodic spell of dry weather, it is simply a waste of time and money to try and grow mealies without first putting the land in good fettle. Last year the crop at Vereeniging averaged 12½ bags to the acre; but on one piece of land that had not been properly fitted and packed only 1½ bags were reaped. Now the consolidator is put over all fields. The mealies are carefully selected, thinly planted about 4 inches deep, and rows are set 3 feet 9 inches apart. Mr. McLaren has already started experiments with

summer moisture sowing fallows: and he hopes at no distant date to have 3,000 acres under crop and another 3,000 acres set apart in preparation of the seed bed by constant harrowing and accumulating moisture for future crops.

Mr. F. B. Smith, the Director of Agriculture, in his lectures delivered to the students of the South Eastern Agricultural College at Wye, was accustomed to lay special stress on the words *fine, firm* and *moist,* and these simple terms are the all-important factors in the foundation of the ideal seed bed and sum up the whole problem of the perfect preparation of the soil.

In future issues we propose to speak of what has been done by the farmers of the Transvaal with ordinary farm implements. We can learn much from America, but it will always be more satisfactory to show what can be done by our own agriculturists.

Finally, we may say that our recent studies lead us to believe that it is along the lines of dry land farming and plant breeding—more particularly in the development of drought resisting crops by selection and hybridization—that we must look for the greatest advance in agricultural science, and impress more and more upon us the incalculable importance of this work to the farmers and to the State. Furthermore, we firmly believe that what has been accomplished in Western America can be done in South Africa. With this end in view, we would earnestly advocate the early establishment of at least one Arid Experimental Farm for the purpose of demonstrating the practicability of farming in regions where the rainfall is scanty or irregular, and where irrigation is not possible. At first, and in order to lessen the initial cost, such an experimental farm might be classed as a sub-station attached to the Transvaal Department of Agriculture. Moreover, we venture to maintain that in dry-land farming will be found the key to the great problem of agricultural development in South Africa, and also to that larger issue of a prosperous land settlement in many of the uninviting and waterless wastes which to-day form so large a portion of our Imperial Domain. We are not aware that this matter has been considered before in connection with the agricultural development of South Africa, and it affords us much pleasure to bring it before the farmers of this Colony.

It was with gratification that we observed how well the work of the Transvaal Department of Agriculture was known, and the sympathetic interest it evoked throughout the United States, and how warmly it was appreciated by the officers attached to the various Experimental Stations. It would be a want of courtesy to conclude even a brief report without some slight acknowledgement of that infinite courtesy and unfailing goodwill which the American people so generously render to all those who are interested in the agricultural industry.

(To be continued.)

SELECTING AND JUDGING HORSES FOR MARKET AND BREEDING PURPOSES.

By J. M. Christy, Asst. Principal Veterinary Surgeon.

Introduction.

THE importance of this subject and the lack of systematic study of it amongst farmers in South Africa, and their un-up-to-dateness, slackness, indifference, or whatever you wish to call it, in the practical application of known principles in horse breeding, has suggested to me the writing of this article.

Compared with other countries, the unbiased observer must at once see that many farmers throughout the entire country have practiced haphazard methods of breeding; they simply bred and reared horses without any regard whatever to the demands of the consumer, and the result is that horse breeding is not the great industry that it should be in South Africa.

Many farmers in this country have unsaleable horses on their farms, horses that, while sound or practically so (good, useful animals for certain purposes), are yet unsaleable even at very low figures. What is the reason of this? The reasons, no doubt, are multifarious, but the principal reason, undoubtedly, is to be found in the fact that we have not bred horses for definite purposes, that attention has not been given to the horse markets, and that the wishes, and, if you like, the prejudices of the customer, have not been consulted. We should profit by past experience and aim to produce horses for a definite purpose. We should cater to the demands of the consumer. There never was a time in the past when a good individual of any of the recognised classes would not fetch a fair price, and it is but reasonable to argue that the time is far distant, if it ever comes, when such will be the case.

Horse breeding, when judiciously carried on, has always been, and is likely to be, a reasonably profitable business. There is a danger at the present time, when, owing to the fact that horses are scarce, the horse of no particular breeding or class is commanding a fair price, that many farmers are led to regard a horse of this kind as a profitable animal to produce. Such horses should not be bred, because even when the greatest care and precaution possible is taken in breeding for definite types, there will always be a number of the so-called misfits, which are the first class of horses whose price will be affected by over-production or anything that is likely to cause a depression in the market.

If horses are bred with a definite object in view, the breeder will not be seriously affected by over-production. There has always been, and there always will be, a fair demand for any of the recognised market types of horses. One of the greatest evils in the horse breeding business is the patronage of the impure bred sire, whose services can be had at a low fee. Nothing but pure bred sires of the very highest quality should be used. There are even many pure bred sires which should never be used for breeding purposes. Just so long as farmers will patronise inferior animals, there will be plenty of them in use. Just so soon as farmers reject them there will be a noticeable difference in the number of inferior horses imported from other countries and kept in this country for breeding purposes. To be a successful breeder of horses, the following points are very essential. A man must be perfectly familiar with the horse markets, he must have a perfect knowledge of the various market classes, and know just exactly what constitutes each class. Then he must decide which of those classes is best suited to his tastes and environments, as some men are competent to produce one class of horse—for instance, the saddle horse, successfully, while they may make a total failure in producing some other class such as the draft horse. Probably the most important requisite is that the breeder be a good judge of a horse, possessing, as it is aptly expressed, "an eye for a horse," some undefinable power or gift or knowledge or surmise of imagination, understanding, faculty, acquirement or natural disposition. Further, he must understand the proper confirmation, action and characteristics of the horse he is trying to produce, and the greater his knowledge of the internal structure, as the bones, muscles, ligaments, nervous system, etc., the better. He must have a clear and well defined idea of the type of horse he is going to breed, and then set out with a fixed determination to produce the same. He must not expect that every horse he raises will be of just the type he desires, and he will be a most fortunate man if fifty per cent. approach his ideal. There will always be some misfits, horses which do not belong to any distinct market class.

Classes of Horses that can be Profitably Produced.

I thoroughly appreciate that here I enter on very contentious and debatable ground, and do not expect all my readers to see eye to eye with me; however, I think that the majority will agree that, under existing circumstances, there are at least four distinct classes of horses that most farmers can profitably produce, namely, the draft horse, the carriage or coach horse, the roadster and the saddle horse, and, for convenience of description, I shall treat of them in this order, but by doing so do not in any way emphasise the respective value or merits of any one class above the other, as I have already indicated the influences that should help the breeder in arriving at a decision as to the class of horse he desires to produce. There is a market for other classes of horses at the present time, but none of them command

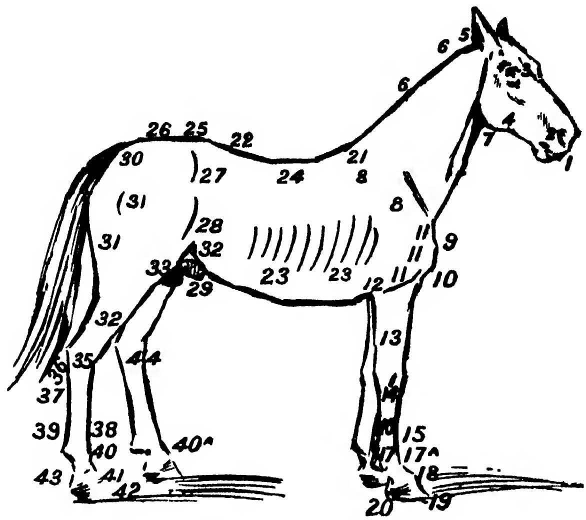
very high prices, as most, if not all of them, are the misfits which are bound to appear from time to time in the effort to produce the four classes mentioned.

The Draft Horse.

In Europe and America the draft horse is one of the most profitable classes of horses that the farmer can produce, and, to a lesser extent, this should hold good in South Africa. He can be reared with less risk and liability to accident than those of the lighter classes, due to the fact that his disposition is quiet and he is not liable to injure himself through spirited exercise and playfulness. Furthermore, small defects and blemishes which detract so seriously from the value of the harness or the saddle horse, are not considered to be so objectionable in the draft horse. He can also be made to earn his living after three years old, and his education can be completed on the farm—thus the farmer who breeds him can secure his real market value. In the case of the coach horse or the saddle horse, the middleman who educates him usually reaps a much greater profit than the man who has produced him. This is not true of the draft horse. Some of the essential points to be considered in selecting a draft horse are—good feet and legs, weight, a well developed body, and good style and action. A draft horse without good feet is worthless on any market, hence good feet are the very first essential of a draft horse, or, in fact, of any class of horse. The hoofs should be large, round and wide at the heel. They should have width but not be too deep nor too shallow. The horn should be of good quality as indicated by its denseness. The wall must be strong and not inclined to be flat. The legs should be well set under the body and possess plenty of substance as indicated by the quality and amount of bone and the development of muscle on the forearms and hind quarters. In some countries weight is looked upon as of great importance; it should be from 1,400 lbs. upwards, the more the better, provided it is combined with good feet and legs. The body should be deep, wide and strongly coupled, as indicated by the shortness of back and muscling of the loin. Good action is essential, as indicated by the length of stride, quickness of step and straight-away movement. Draft horses weighing 1,400 lbs. and upwards can be produced by breeding good draft mares which combine size and quality to a first class sire of any of the recognised breeds of draft horses, as the Shire, Clyde, Percheron, Rheinisch-Belgischer or Belgian. Any of these breeds contain many excellent horses. Each breed has its own peculiarities, perhaps advantages and disadvantages, be that as it may, be sure and select a good sire, one that possesses individual excellence backed up by good ancestry.

The accompanying plate shows the different parts of the horse, and is inserted for the benefit of those who are not familiar with the names of these various parts. It will also be helpful in enabling

the reader to follow and better understand the detailed description of the desirable points in the confirmation of the various classes.



Points of the Horse.

KEY TO PLATE.

HEAD.—1 Muzzle. 2 Nostril. 3 Forehead. 4 Jaw. 5 Poll (seat of poll evil).

NECK.—6-6 Crest. 7 Windpipe. 7a-7a Jugular Furrow (where bleeding is usually performed and intravenous injections carried out).

FORE QUARTER.—8-8 Shoulder Blade. 9 Point of Shoulder. 10 Breast. 11-11 Arm. 12 Elbow (seat of capped elbow). 13 Forearm. 14 Knee. 15 Cannon Bone (seat of sore shins). 16 Tendon (seat of breakdown). 17 Fetlock (seat of wind galls). 17a Pastern. 18 Coronet (seat of ring bone). 19 Hoof. 20 Heel.

BODY. 21 Withers. 22 Back. 23 Ribs. 24 Girth. 25 Loins. 26 Croup. 27 Hip. 28 Flank. 29 Sheath or Prepuce. 30 Root of Tail.

HIND QUARTER.—31 Hip Joint. 32 Stifle Joint. 33-33 Gaskin or thigh. 34 Quarters. 35 Hock. 36 Point of Hock (seat of capped hock). 37 Location of Curb. 38 Cannon Bone. 39 Back Sinew. 40 Fetlock Joint. 40a Pastern. 41 Coronet. 42 Hoof. 43 Heel. 44 Location of Spavin.

POINTS TO BE OBSERVED IN SELECTING DRAFT HORSES.

In selecting a draft stallion, the following points should be observed:—

Head.—Coarseness of the head must be guarded against; ears should be somewhat short, pointed and not too wide apart at base; forehead broad and rather flat with a straight nasal bone; eye bright, full and mild, with no appearance of a film to interfere with the vision (the natural shape of the eye is elliptical, a spherical form indicates blindness or impaired vision); nostrils large and pink in colour, muscle of the cheek well developed, lips firm, mouth of medium size and teeth regular and meeting those of opposing row accurately.

Neck.—Medium length, deep at junction of body, continuous with the withers without any line of demarcation, crest well arched,

broad and strong, but not so heavy as to turn to either side. The whole neck should be well muscled and surmounted by a good heavy mane.

Withers.—In a line with the neck, rather broad, well defined and strongly muscled.

Shoulders.—Medium slope. Extreme slope of shoulders is conducive to good action but is objectionable from a draft standpoint; on the other hand a very upright shoulder is associated with a long back and stubby paterns, conducive to poor action, as the direct concussion is very liable to cause sidebones and ringbones. The muscle covering the blades should be well developed.

Chest.—Deep and comparatively broad, giving plenty of volume and lung room, which indicates stamina. Legs must be set on the outside but well under the body. When the legs are very wide apart the horse usually has a rolling action.

Arm.—The bone forming the arm short and sloping so as to bring the legs well under the body, also well muscled.

Elbow.—Strong and muscular, turning neither in nor out, but fitting closely to the chest.

Forearm.—Large and very heavily muscled. This is a very important point and one in which a great many horses are very deficient.

Knee.—Well developed, broad from side to side, and deep from before backwards, straight from a side view, neither bending forward, called over of the knee or knee sprung, or backward called calf knee. It is very important that the knee be well supported, as there should not be the slightest tendency to cut away below the knee, spoken of as tied in below the knee, a very common defect in otherwise good horses.

Knee to Fetlock.—That portion between the knee and the fetlock, called the cannon bone, broad and flat and free from meatiness, tendons wide, hard, prominent and must not be tied in below the knee. In the case of the Shire and Clydesdale, there should be a fringe of fine straight silky hair starting from the knee and running to the fetlock. This hair is commonly called "feather," and should not be found on the front of the leg. In the Percheron and Belgian, not so much hair is found.

Fetlock.—Fetlock joint wide and well defined so as to give plenty of space for the proper attachment of the tendons that pass this joint.

Front Pasterns.—Medium length, strong and fairly sloping. The slope of the pastern has much to do with the durability of the horse's feet and tendons, and a marked influence on his action. A short upright pastern causes direct concussion which is very jarring and hard on the horse if on pavement or macadamised road; he will soon throw out sidebones or ringbones. On the other hand a draft horse may have too much length and slope of pastern so much that he will be weak in his pasterns and liable to strain his tendons.

Front Feet.—Good size, rather round, with a strong wall, not flat, not blocky; heels wide and neither too shallow nor too deep,

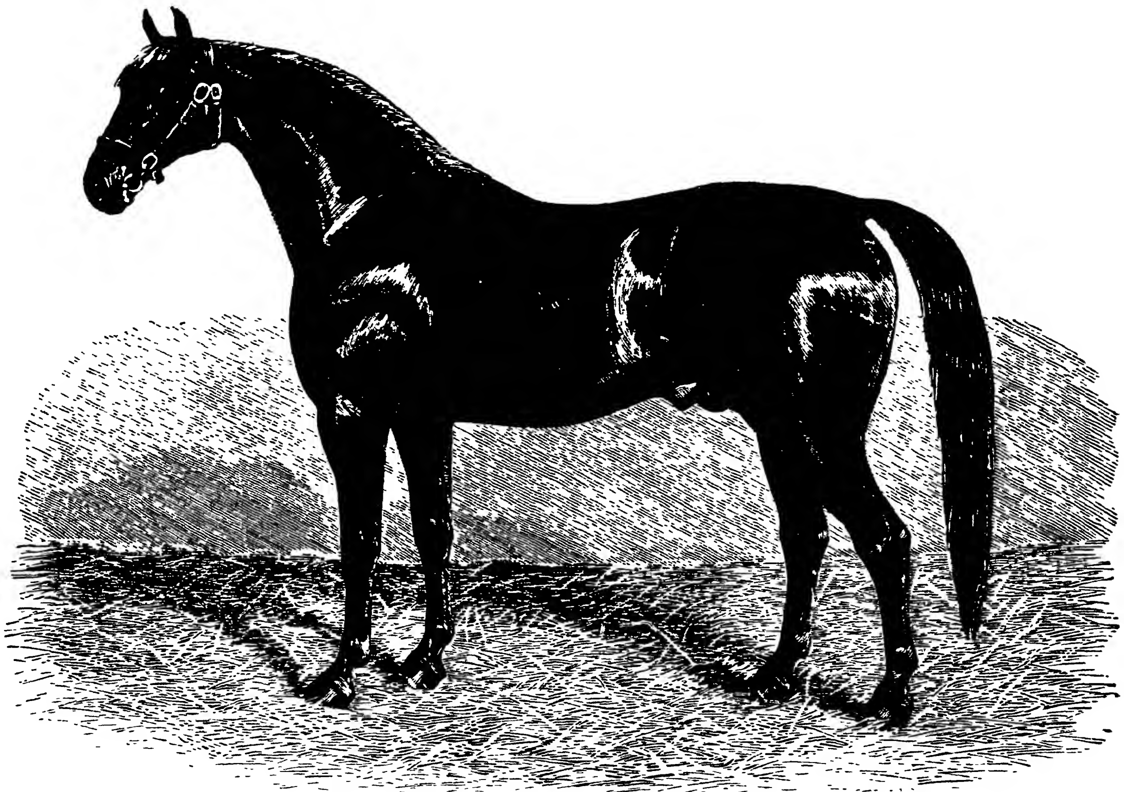


Plate CLXII **The Carriage Horse.**

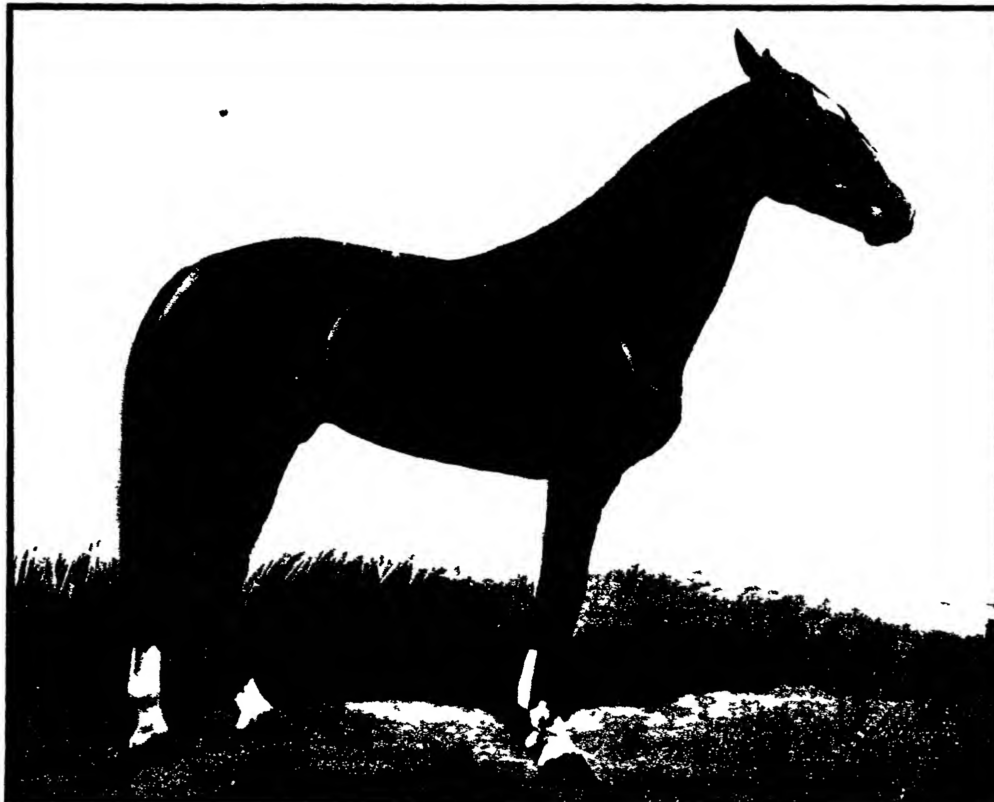


Plate CLXIII **The Roadster.**

frog well developed, toes turned neither in nor out (pigeon-toed, lady-toed) but perfectly straight.

Body.—The typical draft horse stands somewhat high in front, and the shoulders and withers blend nicely into the back, giving a short strong appearance, ribs well sprung with much depth, fore flank well filled out indicating chest capacity, giving good lung room. A horse well let down in his flank has one of the best indications of a good feeder.

Loin.—Thick, broad and very heavily muscled, as it is here that the propelling power of the hind quarters is located.

Croup.—Broad and heavily muscled, not too drooped (goose rumped), but out rather straight to the tail, well carried and full haired.

Haunch.—Heavily muscled, thick through the ham and hind quarters, broad and well muscled (well let down).

Stifle.—Well defined, strong and well muscled.

Gaskin.—Very heavily muscled, the bone large, indicating strength.

Hock.—Large and strong and well developed in all directions; point well developed, back border straight, not round (sickle or cow-hock) and joint free from all puffiness.

Hock to Fetlock Joint.—Cannon bone and feathering same as in the forelegs, tendons well developed without pinched or tied-in appearance below the hock, hard and clean, without any appearance or indication of meatiness or gumminess.

Fetlock Joint.—Broad, strong and well defined.

Hind Pastern.—Medium length and slope, and of a strong conformation.

Hind Feet.—Large, though not as large as the front feet, of even size, horn dense, sole concave with strong bars, and a well developed elastic frog, heel wide, one half the length of the toe, and vertical to the ground.

Colour.—Bay, black, brown, chestnut, grey, sorrel, roan, with reasonable modifications so far as the face and leg markings are concerned.

Skin.—Soft, mellow, loose, with a fine flossy coat of hair.

Temperament.—Energetic, docile and not nervous.

Style and Action.—General appearance attractive, movement smooth, quick, long, elastic, balanced in the walk and rapid. Straight and regular in the trot.

Weight.—From 1,400 lbs. upwards.

Height.—15.3 hands high to 17 hands high.

The conformation of the draft mare and gelding is of the same general type as that outlined for the stallion, with the exception that they must not be so masculine in appearance nor so large. The mare or gelding should not be over sixteen hands in height; special attention should be paid to the feet and legs and quality, as they are of great value from a durability and market standpoint. If ever in doubt as to the merits of two draft animals, always give the benefit

of the doubt to the better bred one, in ninety-nine cases out of the hundred their subsequent history will go to confirm the soundness of your judgment.

Carriage or Coach Horse. (Plate CLXII.)

The ideal carriage or coach horse is an animal of high excellence of form, style, action, speed and education. He must be of good size, standing from 15.2 to 16.1 hands high and weighing in the neighbourhood of 1,200 lbs. and upwards. He must be endowed with good style as indicated by a clean cut head gracefully carried on a lengthy well arched neck, which must blend nicely with the shoulders and back so as to present an elegant contour. He must possess smoothness of back, loin and hind quarters which must not be too drooping. The tail should be well carried and full haired. He must have free, easy, high and attractive action of both knees and hocks. In addition to high action he must move in a straight line, as neither paddling, dishing nor rolling of the front feet is admissible. He must not go wide behind nor yet close enough to interfere, brush, strike or cut himself. Action is an essential point and must receive due consideration in the carriage or coach horse. A few years ago speed was not regarded as very necessary, but at the present time it is much in demand, and adds very considerable to the market value of this class of horse. Good feet and legs are essential points to be sought for in producing such a horse. Extremely high knee and hock action is very hard on the feet and legs, and an animal possessing it will soon pound himself to pieces on hard roads. The duration of the period of usefulness in the carriage or coach horse will be increased or shortened by the conformation of the legs and the size and construction of the feet. The pastern should be sloping, so as to do away with direct concussion, which is so hard on the internal structures of the foot. The foot should be large, round, with a well developed frog, and good width of heel.

Some men, who are naturally adapted to educating and training horses, can produce carriage or coach horses much more profitably than draft horses. Horses of this class possessing the desired conformation, style, action and speed, command very high prices and are always in great demand. Perhaps, at the present time, there is a greater demand for this class at high prices than for any of the other distinct marked types, due to the fact that they are scarce and difficult to get, as most farmers have been following wrong methods in trying to breed such horses. The true high-class type of carriage or coach horse is difficult to produce. So many things are demanded of him, and if any one is lacking he is almost worthless. His production, notwithstanding his very complex nature, is not accidental however. He can be produced with average regularity when proper methods of breeding are pursued.

Many enthusiasts have maintained that there was but one fountain head from which all ideal carriage or coach horses must arise, and that was the Hackney. They have had a fair trial, but, in-

many instances, have been found wanting. The progeny of the Hackney sire and the average mare in most instances have been unsatisfactory. Many of them possess good form, action and style, but are lacking in size, speed and stamina, the latter especially. The German coach, the French coach, and the Cleveland Bay have each their admirers and advocates, but they, like the Hackney, have in most instances fallen far short of reaching the desired standard. The progeny of such sires usually have sufficient size, style and action, but they also are lacking in speed and stamina. It is also very difficult when using such a cross to get horses that have good feet and legs. The Cleveland Bay cross in most instances stands too high and is thus liable to be weak in his legs. The most satisfactory way of producing the coach or carriage horse is by the use of a thoroughbred sire with size, action, style, quality and bone: an American trotting horse sire which has plenty of size combined with style and action or a well-bred South African sire with size, action and style. This method of breeding will usually give an animal with plenty of speed and abundance of stamina. No matter what particular breed of sire you decide to use, see that he has plenty of size, good bone and feet and good ancestry.

Points to be considered in selecting a Carriage or Coach Horse:—

In selecting a stallion for carriage or coach purposes the following points should be observed:—

Head.—Ears of medium size, fine and approaching each other at the tips when pointed forward, and not too wide apart at the base. Forehead broad and flat. Bones of nose straight in front and slightly dished on lateral surfaces; muscles of cheek well developed. Eye prominent, clear, and eliptical in shape. Nostrils large, pink and flexible. Mouth of medium size and teeth regular, meeting those of the opposite jaw accurately.

Neck.—Rather long, head gracefully attached and carried well up; crest well developed and nicely arched and surmounted by an even silky mane.

Withers.—Well developed and not too thick on top.

Shoulders.—Sloping and well muscled. Slope of shoulders is very essential in the carriage or coach horse as a sloping shoulder allows of a well carried head and neck and is also associated with good action.

Chest.—Deep and of medium width. A wide chest, while indicative of constitution, is usually associated with rolling action.

Arm.—Strong and thrown well forward.

Elbow.—Strong and muscular, turning neither in nor out but fitting close to the body.

Forearm.—Good length, strong, muscles well developed and standing out boldly.

Knee.—Broad from side to side in front, deep from before backward, and straight in all directions.

Knee to Fetlock.—Cannon bone broad and flat, tendons well developed and prominent, skin lying close to bone and tendons, and

no tying-in below the knee. Free from any great number of long hairs.

Fetlock.—Fetlock joint wide and well defined so as to give plenty of room for the proper attachment of the tendons that pass this joint. Small round fetlocks are a serious defect in a carriage or coach horse, or, indeed, any class of horse.

Front Pasterns.—Sloping, medium length and strong.

Front Feet.—Good size, rather round, with a strong wall, heels wide and neither too shallow nor too deep; horn dense, wall strong and frog well developed.

Body.—Short and strong, loins wide and well muscled, ribs well sprung and closely coupled with a good depth of flank (well ribbed up).

Croup.—Medium width, carried out fairly straight to the tail, which should be full haired and well carried.

Haunch.—Muscles well developed and standing out boldly.

Stifle.—Strong, well defined and heavily muscled.

Gaskin.—Strong and well developed, muscles standing out boldly and well defined.

Hock.—Large and strong in all directions, point well developed; posterior border straight, an absence of coarseness and puffiness.

Hock to Fetlock Joint.—Cannon bone clean, broader and flatter than the front ones, tendons standing out boldly, well defined, and without any indication of beafiness.

Fetlock Joint.—Fetlock broad, strong and well defined.

Hind Pastern.—Sloping, medium length, and strong.

Hind Feet.—Same as front feet but not so large.

Colour.—Bay, brown, black, chestnut, sorrel, roan, grey, with reasonable modifications. White legs, especially in high actioned horses are often desired, though some people object to them. In this class a good horse may be a bad colour. Fashion must not be lost sight of here.

Skin and Hair.—Soft, mellow, loose skin; fine silky coat of hair.

Temperament.—Energetic, docile not sluggish, and free from nervousness.

Style and Action.—High and straight away, free and elastic; knee well bent, fore feet lifted well off the ground when in motion and brought straight forward, neither paddling nor rolling; stride long with an absence of the tarrying action sometimes seen. Hocks well flexed and hind feet lifted well up, not going wide nor yet close enough to strike the opposite ankle. In some countries, a horse that does not lift his front feet as high as his knees and his hind feet seven inches off the ground when in motion is not considered to have high action.

Weight.—1,000 lbs. to 1,400 lbs.

Height.—15.2 to 16.1 hands high.

The conformation of the carriage or coach mare and gelding is of the same general type as that outlined for the stallion, with the

exception that they should not be so masculine in appearance, and that their weight and height may be somewhat less.

The Roadster. (Plate CLXIII.)

The roadster horse, or gentleman's driving horse, is in good demand at the present time despite the fact that the automobile has made its appearance on our roads and streets. I do not hold with those who maintain that this class of horse has seen the days of his greatest usefulness, and that his star is no longer in the ascendant. Let me state here that a good and valuable roadster should not be considered as necessarily a regular flyer or race horse. In some countries, especially North America, road or track racing is very popular, and great speed is highly valued and sought after, but in this article I will confine myself to outlining the essentials of a good ordinary roadster, leaving to others of greater experience and capabilities the task of describing the road or track race horse. That a market for this latter class of horse could be established in this country would appear to be suggested by the requirements of Johannesburg and other centres of large population; but enough of this, which is a digression from the chief object I have in view, and, further, few race horses ever make satisfactory roadsters.

The roadster should be of fair size, 15 to 16 hands high, of good and graceful conformation, good colour, stylish looking, a free driver and capable of travelling twelve to fifteen miles an hour on a good road. He must have good action, not especially high, but long, straight and regular. He may either trot or pace (triple). This class of horse is sired by a thoroughbred with bone and action, an American trotting bred stallion, or a South African bred stallion with the necessary size and action, and, all the better, if the dam has a trotting bred strain in her pedigree—ancestors noted for their excellence in this particular gait or movement. In this class, as in the others mentioned, size, combined with plenty of quality, is a necessity. Too many roadster horses are almost worthless on account of lack of size. The ideal roadster is the animal that has sufficient size and strength combined with speed to enable him to drag two in a buggy over heavy roads. When two such horses are inspanned in a Cape cart they will take it over the road in a surprising manner. Many roadsters are deficient in bone, therefore, in breeding roadsters, special attention should be given to size and bone as they are very essential in the make up of a high-class roadster horse.

Points to be considered in selecting a Roadster Horse:—

In selecting a stallion to breed a roadster horse, the following points should be observed:—

Head.—Ears of medium size and pointed, eyes large, prominent, and of docile expression; bones of the nose straight in front and slightly dished laterally; bones of cranium nicely rounded; nostrils pink, form large and easily dilated; muscles of cheek well developed but not too heavy; muzzle fine and tapering; mouth of medium size; lips firm; teeth regular, meeting those of the opposite jaw accurately;

branches of lower jaw well spread apart at their angles to allow plenty of space for the upper part of the windpipe and posterior part of the mouth, thus conducing to free and easy respiration.

Neck.—Rangy, with a well developed crest and attached to the head in an angular sort of way, rather of obtuse order.

Withers.—Should be continuous with the superior border of the neck, well developed and not too broad.

Shoulders.—Oblique from above downward and forward, blade well covered with muscle.

Chest.—Very deep through the girth, breast deep and well filled but not too broad.

Arm.—Strong and well set in.

Elbow.—Well muscled and lying close to the chest.

Forearm.—Well developed and strong, with muscles well defined and standing boldly out.

Knee.—Straight and strong in all directions, free from malformations.

Knee to Fetlock.—Cannon bone rather short, broad, flat and rather clean, tendons well defined and prominent, not tied in beneath the knee, and free from all beafiness or gumminess.

Fetlock Joint.—Wide and well defined.

Front Pastern.—Strong, of medium length and obliquity.

Front Feet.—Of medium size, rather round, with strong wall, sole rather concave, frog large and well developed, heels broad, strong, and not too deep, toes neither turned in nor out.

Body.—Back straight and rather short, loins broad and well muscled, ribs of good depth, with well marked angles.

Croup.—Broad, well muscled and out straight to tail, which should be full haired and well carried.

Haunch.—Muscles well developed, deep through ham, quarters broad and strong.

Stifle.—Strong, well muscled and compact.

Gaskin.—Muscles prominent and hard.

Hock.—Large and strong in all directions, all parts well developed, free from malformations and puffiness, posterior border straight.

Hock to Fetlock.—Cannon bone rather short, broader and flatter than in front, tendons clean and standing out prominently.

Fetlock Joint.—Large and strong.

Hind Pasterns.—Strong, of medium length and obliquity.

Hind Feet.—Smaller and not so round as in front, sole more concave, frog well developed, heels strong and not too deep.

Colour.—Bay brown, black, chestnut, roan and grey, with reasonable modifications.

Skin and Hair.—Soft, mellow, loose skin, fine sleek coat of hair.

Temperament.—Docile, kind, prompt, energetic and not too nervous.

Style and Action.—Free and elastic, perfect in trotting gait, a good walker, must not paddle or roll in front, may go wide behind,

may either trot or pace, must go level without hitting any part, and be able to go fast.

Weight.—900 lbs. and upwards.

Height.—14.3 to 16 hands high.

The above description will apply to the mare and gelding of this class, except that they will not be so masculine in appearance. The neck should be more delicate and cleaner cut, the crest not so well developed, the withers more prominent, not so thick through and through at the upper part, and there should be a slight line of demarcation between the withers and the neck.

The Saddle Horse. (Plate CLXIV.)

I approach this part of my article with a certain amount of diffidence, not because it is difficult to describe the ideal riding horse, but because the "man in the street" knows, or thinks that he knows, all about the saddle horse. I have met plenty of men who placed very high values on their riding horses which to others, equally qualified to arrive at a judgment, did not appear to possess any special or excellent points, in fact one would be tempted to think that said points existed in the owner's imagination only. Then again, the term saddle horse is such a comprenhensive one, including such different kinds, as for example, the race horse, the hunter, cavalry horses, mounted infantry cobs, polo ponies, ladies' and gentleman's hacks, shooting ponies, etc., that it would require a volume in itself to do justice to so complex and interesting a subject. I will, therefore, confine myself to outlining, in a general way, the essentials to be looked for in an ordinary riding horse, leaving it to the reader to decide for himself the particular kind he desires to produce, as the chief characteristics of all riding horses are very much the same, the difference being more in size than actual points. I do not ask all my readers to agree with my ideal of the saddle horse, but I do ask them to take what I say as the sincere expression of my ideas and views on the matter.

The saddle horse is always in good demand, and is a profitable animal to produce. He is almost without exception the progeny of the thoroughbred or the Arab, or of their descendants, such as, for example, the South African horse, or the American saddle horse. The real high-class thoroughbred possesses more quality than any other class of horse. He is clean cut, impressive, breedy looking, and a gentleman in every respect. On account of his clean cut appearance and quality a coarser class mare can be bred to this class of horse than to others. His progeny, except from extremely coarse mares, are seldom lacking in quality and ambition. Horses of this class (from coarse mares), are often called combination animals, being useful either in the saddle or as a harness horse, ride and drive horses.

The saddle horse may be either a plain gaited walk, trot and canter horse, or a horse with at least five distinct gaits, walk, trot, canter, pace and single foot, but both must possess perfect manners. The market for a good sized saddle horse is and always has been good. Many

saddle horses are undersized. The heavy weight saddle horse, capable of carrying up to 220 lbs. and over, is a rare animal, and always commands a very high price. He is much harder to produce than the smaller animal, and for this purpose a large mare should be selected, 1,000 lbs. or more, with as much ambition and quality as possible, and bred to a good big thoroughbred stallion, weighing in the neighbourhood of 1,200 lbs. There is always a good demand for the light weight saddle horse, but he does not command such a high price, being more numerous—to perpetrate an "Irish bull" there is more of him.

The gaited saddle horse, or the combination gaited and carriage horse is in good demand and popular in South Africa. This class of horse should be very attractive in appearance, docile in disposition and as well mannered as the saddle horse, responding readily to the hand and voice of his rider or driver.

Points to be observed in selecting a Saddle Horse :—

For this purpose, I shall describe the thoroughbred stallion, and the following points should be sought for in his conformation :—

Head.—Ears fine, not too long, approaching each other at the tips when thrown forward, cranium broad and nicely rounded to allow of good brain capacity, as the thoroughbred must possess considerable intelligence. Forehead flat and broad. Eyes wide apart and bold in expression, denoting courage and spirit. Nasal bones straight in front, but slightly dished on lateral surfaces. Nostrils firm, large, pink and flexible, of large capacity when the animal is excited, lips firm. Mouth medium size. Teeth even and meeting those of the opposite jaw accurately, neither over-shot (parrot mouth) nor under-shot (pig mouth). Muzzle small and tapering. Cheeks well but not too heavily clothed with hard well-developed muscles. Branches of lower jaw well spread apart at their angles.

Neck.—Clean cut and rangy, crest well developed and whipcordy, but not so heavy as in other classes ; head attached to neck in a graceful angular manner, jugular furrow or gutter well developed.

Withers.—Well developed, high and not too wide on top, but moderately wide topped withers do not constitute a fault in a horse required for jumping purposes, like the Irish hunter.

Shoulders.—Long and oblique, so as to give easy action. Shoulder blades fairly broad and well covered with muscles.

Chest.—Deep, giving good girth, with a well filled but not too broad a breast.

Arm.—Thrown well forward so as to give an oblique shoulder.

Forearm.—Long, well developed and strong; well clothed with hard well developed muscles, having grooves of demarcation between them, showing the outlines of each individual muscle.

Knee.—Clean, straight, large and long in all directions, and the small bone (the pisiform) forming the back part somewhat prominent.

Knee to Fetlock Joint.—Cannon bone short, broad, flat and clean, tendons standing out plainly, hard and whipcordy. The lines of demarcation between the tendons and ligaments and between ligaments

Plate CLXIV **Thoroughbred Mare and Foal.**

and bone well defined with plenty of support beneath the knee, not showing any tendency to weakness.

Fetlocks.—Strong and well supported.

Front Pasterns.—Strong, medium length and oblique.

Front Feet.—Rather smaller in proportion than other breeds, round, strong and fairly deep wall, sole concave, frog well developed, heels full and not too deep, toes neither turning in nor out while standing.

Body.—Back strong and inclined to be short, with a long underline, loins broad and well muscled, ribs well sprung and of good depth.

Croup.—Well muscled, carried out straight to tail, which should be full haired and very stylishly carried.

Hock.—Deep and strong in all directions, all points well developed but not rough, absence of malformation or puffiness, point very well developed, straight on posterior border, the whole joint clean, hard and of an angular order.

Hock to Fetlock.—Cannon bone short, wider and flatter than in front, tendons well marked individually, and must not have a pinched in appearance below the joint in front, but very gradually taper in width from hock to fetlock.

Fetlock Joint.—Large, clean cut and strong.

Hind Pasterns.—Medium length, sloping and strong.

Hind Feet.—Smaller and not so round as the front ones. Sole more concave, frog well developed, heel good width and not too deep.

Colour.—Bay, brown, chestnut, black, roan and grey, with reasonable modifications.

Skin and Hair.—Skin soft, mellow and loose ; hair fine, silky and straight, hairs of mane and tail, although coarse, straight and soft in comparison with other breeds.

Temperament.—Mild, energetic, not vicious or too nervous.

Action.—Prompt, free and elastic, not too much knee and hock action, but going close to the ground, especially in the canter and gallop. No paddling or rolling in front, hind feet not to go close enough to interfere, a good straight away walker.

Weight.—1,050 to 1,300 lbs.

Height.—15 to 16 hands high. The above description will apply fairly well to the saddle horse or mare, except that they will not be so masculine as the stallion. Unless they are thoroughbred they will not possess so much quality. They must have good manners, with a mouth that responds readily to the hand of the rider. They must also possess graceful and elastic action in all paces.

In bringing this article to a close, I would caution my readers against being over sanguine. Selecting and judging horses for market and breeding purposes is a difficult and tedious undertaking, calling for great patience and skill. Dispiritments and contradictions are to be expected, but in the soul stirring words of Carlyle, I would say to those who go in for it, "Fight on thou brave true heart and falter not through dark fortune and through bright," conscious of "Man's noblest tendency, his perseverance and man's ignoblest, his inertia."

FARM IRRIGATION IN THE TRANSVAAL.

By C. D. H. Braine, Assoc.M.Inst.C.E.
(Executive Engineer, Transvaal Irrigation Department.)

IN January, 1905, the Governor of the Transvaal and Orange River Colony appointed a Commission, known as the Inter-Colonial Irrigation Commission, to enquire into and report upon many important questions referring to irrigation in the two Colonies.*

Part of my duty, as Secretary of the Commission, was to hold meetings in various parts of the Transvaal, so as to explain to farmers and others the work being done by the Commissioners and to discuss with them the various suggestions under consideration. The total number of meetings held amount to forty-seven, and in going from place to place I have travelled over the greater part of the Transvaal. During the tour I took every opportunity of visiting the irrigated farms along the route, and I found farm irrigation in a very primitive condition. One or two farms stand out as brilliant examples of what can be done; but, in most cases, the work is very unsatisfactory, and shows great lack of knowledge and care, water being often badly and wastefully used. Proper irrigation is the result of scientific as well as practical knowledge, and the most successful men are those who irrigate with due regard to sound principles. These principles are not generally understood by our farmers, and I believe no experiments on the duty and use of water have ever been made in South Africa until last year. It is greatly to the credit of the Transvaal Agricultural and Irrigation Departments that such experiments are now being carried out at Potchefstroom; but they have not been instituted long enough to give decisive results. Many experiments of the sort have, however, been made in the United States of America, and, as the climatic conditions in the Western States are so similar to those in South Africa, the important results obtained should be invaluable to irrigators in this Colony, and form a useful guide to our own experiments. The bulletins and other publications on the subject are not known to the average farmer, and it should be part of the duty of every Irrigation Engineer to keep in touch with the work being done in other countries, and impart the knowledge to our agriculturalists. There is so much to be learnt on the subject, and the results are of such financial value, that it would be in the interests of agriculture if Government Experimental Irrigation Stations were started in various parts of the country.

*The Commission consists of the Hon. Mr. Justice Wessels, Messrs. W. L. Strange, M.Inst.C.E., J. Rissik, J. A. Neser, E. Rooth, G. D. Adamson, E. R. Grobler, and C. D. H. Braine, Assoc. M.Inst.C.E., Secretary.

To give an idea of ordinary farm irrigation, I will describe the conditions existing on a farm that I inspected. The system employed was undoubtedly injurious to the crops. The orange trees were growing in the furrows, and were naturally in an unhealthy condition. The young shoots were dying off, and the leaves turning yellow, altogether showing signs of improper irrigation. The water should have been kept well away from the base of the trees, so as to induce the roots to spread. It is a rule amongst advanced irrigators never to irrigate within the area covered by the shade of the tree at noon; but the irrigation of fruit trees on that farm was limited to this area. Consequently, all the roots are confined to a restricted space close to the trunk of the tree, and, should no irrigation be possible during a drought, many of the trees would undoubtedly perish. Then, again, it was the custom to irrigate twice a week, using comparatively small quantities of water—for orchard irrigation this is a fundamental mistake. The small crop of oranges on the mature trees was ample proof that the system of cultivation was radically wrong. It is also a great mistake to plant fruit trees in the water-logged soil near the furrows. I have seen several instances of diseased trees caused by this, and one of the leading farmers of the Rustenburg district told me he had noticed the same thing. A friend of mine in Kimberley once expressed his surprise that although he irrigated his trees every day, he never got any fruit. That was a natural result of over irrigation, and if scientific irrigation were better understood there would be fewer disappointments.

Now I will give an example of better methods. It is in the Barberton district, and the farmer, in this case, has one of the healthiest looking orange orchards that I have seen in the Transvaal. He grows nothing but trees in his orchard, and there are neither grass nor weeds. The surface soil is broken into a loose tilth which prevents the sub-soil drying up, and when he irrigates the water is allowed to soak into the ground between the trees. This he only does twice a year during the winter, and, after irrigating, the surface is well cultivated. There were no symptoms of root-rot, and no leaves turning yellow. The farmer knew that the roots extended over 25 feet from the tree, and it was those roots he wanted to water. I saw another notable instance on a farm in the Rustenburg district, where the water supply had practically ceased; but there again the surface was covered with a fine tilth, and under the branches, where the plough and harrow could not be used, the soil was broken up with a fork. The correct practice is to apply heavy irrigations at as long intervals as possible, depending on the nature of the soil and the kind of tree; and the distance from the trunk at which the water should be applied varies with the size of the tree. This perennial variation induces the roots to spread themselves out towards the moistened soil, producing a larger area from which the tender roots can draw nourishment and moisture. If copious irrigations are used the trees become deep rooted, and will safely withstand any ordinary drought.

I have seen many farms where the field furrows have been laid out on far too steep a gradient—so steep that an appreciable quantity of soil is being washed away at each irrigation. This, of course, is quite wrong, for it not only carries away some of the best soil, but also cuts up the fields very badly. Then, too, the beds (or acres as they are sometimes called by the Dutch farmers), are not properly prepared. It is not enough to plough them and turn in the water: they should be carefully levelled, so that the water will spread gradually over the surface. Where the furrows and beds have a gentle slope the water has time to sink into the soil, which it does not do to the same extent when rushing over the ground. One has only to examine the lower edge of the fields to see the waste of water and land that is constantly occurring.

One of the most important crops in the Transvaal is tobacco, and there again, in my opinion, the system practised is harmful. All the plants are grown in the furrows, and in the early stages the young plants are often entirely submerged during the process of irrigation. This covers the leaves with a deposit of silt and prevents them performing their natural functions. Little or no attempt at cultivation or inter-tillage is practised, and, naturally, the ground becomes hard and baked, thus supplying the conditions favourable for evaporation. I have seen young tobacco seedlings, as tender as water-cress, struggling through the caked surface of a dry furrow. Then they irrigate to soften the ground, and water is applied too frequently. With proper deep irrigation it would be quite unnecessary to irrigate every two or three days as is the usual practice at present. The young plants undoubtedly require an abundant supply of moisture; but the larger plants, if well rooted, as they would be with deep irrigation, ought seldom to require watering more than once in ten or fourteen days. It is a common thing to see the lower leaves attacked by a white mould. On some farms it amounts to from 20% to 30% of the leaves, and those that are badly affected can only be used for Kaffir tobacco. One of the best known growers in this Colony agrees with me that the mould is largely due to the system of irrigation practised. He also agrees with me that the tobacco plants should be grown between, and not in, the furrows; but he was afraid it would take more water and more work. I pointed out that by this system fewer irrigations would be necessary and, consequently, less work leading water. I admit it would require more care, but the tobacco planter would be amply repaid by a better crop of leaves. It is the opinion of experts that a lighter and thinner leaf would be grown if the tobacco plants were placed more closely together in the rows; but this would cause more shade, and some growers are afraid that there would be an increase of the white mould. This would probably be avoided by a better system of irrigation; but such questions will only be definitely settled by expert observation on experiment irrigation farms.

The amount of tobacco of all sorts imported into the Transvaal during 1904 was £202,575, and in 1905 it increased to £243,702. Now if this valuable local trade is ever to be retained in our own hands, the

tobacco growers must produce large quantities of improved leaves of uniform quality. It is quality, and not weight, that is going to pay in the future.

Many people in South Africa appear to think that irrigation consists entirely of the works necessary for storing, or diverting, water and delivering it to the farmers ; but, while I fully realise the importance of the work that has to be done by Irrigation Engineers, I am also aware that real development does not rest solely with them. The economical use of the water by farmers is a very important factor, and that is the point to which I would like to give special emphasis. The methods employed to-day are little better than those employed by the early settlers. It has been the same in the United States; but the go-ahead people there are alive to the importance of the proper use of water, and the question is being investigated by experts. It has been found that the area of land that could be irrigated by the rational use of water might be doubled or trebled, and it is easy to see what an advantage that would be to this country. It would mean that the cost per acre for water would be reduced to one-half or one-third. This saving of water is obtained by only using the amount required to get the best results. Different crops require different treatment, and improper irrigation is injurious to any crop ; for instance, oats require more water than any other grain; cotton needs very little; too much water spoils tobacco; turnips, parsnips and carrots should never be flooded; and flooding lucerne during the first few months of its life is pretty certain to check the growth.

Much valuable information was given by Dr. J. Widstoe in a paper read before the Twelfth National Irrigation Congress in the United States of America. He said that on a typical western soil, 5 inches depth of water* produced 33 bushels of wheat per acre; 10 inches of water produced 40 bushels. Adding more than 20 inches of water to the field did not appreciably increase the yield of grain. In the case of the wheat plant, then, the increase of the amount of water up to about 15 inches increases the yield of grain, but a further application tends to diminish the yield. When it is considered that the depth of water applied to the wheat, over a very large area of irrigated country, amounts to 30 or more inches annually, it will be understood what a loss in wheat alone occurs year after year through the misuse of water.

With oats the variation is somewhat similar. Five inches of water in one set of experiments yielded about 58 bushels of oats per acre ; 10 inches yielded about the same amount, though the increased quantity of water increased the weight of the straw. With 15 inches 70 bushels were obtained ; with 20 inches 86 bushels ; and with 30 inches 82 bushels were obtained. Covering the land with more than 30 inches of water diminished the yield of oats decidedly. About 20 inches is, therefore, the best amount of water for oats ; yet throughout the irrigated West 30 inches or more are generally used in the

* One inch of water equals 22,600 gallons per acre.

production of oats—and thus again the wasteful use of water is emphasised.

It is generally true, with all the ordinary crops grown in the Western States, that increasing the amount of water increases the yield up to a certain point, after which an increase in the water causes a decrease in the yield. All crops, however, are not alike in this respect. Some crops, because of their nature—leaf surface, root system, etc.—find 10 inches of water about right for the season's growth. Other plants, because of their different natures, find 15 inches or 20, or 25 to 30 inches, the best. Now the farmer in an irrigated district should know the water requirements of the different plants that he grows as thoroughly as he knows the soil of his farm, his water right, or any other matters upon which his success as a farmer depends. Not all plants decrease in yield after a certain amount of water has been applied. Potatoes appear to be a crop the yield of which increases continually if water is applied, up to the limit of the practical application of water. To illustrate:—In one set of experiments 7½ inches of water produced 160 bushels of potatoes; 15 inches 233 bushels; 30 inches 274 bushels; and 71 inches 315 bushels. This illustrates the necessity for the farmer to thoroughly understand the nature of the plants with which he is dealing.

It may be noted, in reviewing the yields of wheat, oats and potatoes just considered, that the value of the first few inches of water applied is much greater than that of the later applications. For instance: 5 inches of water produced about 33 bushels of wheat, or about 6.6 bushels per inch; 15 inches of water produced about 40 bushels of wheat, or about 3.2 bushels per inch of water; while 20 inches of water also produced 40 bushels of wheat, or only 2 bushels per inch. The value of the first 5 inches of water applied to wheat, therefore, is more than three times as much as the value of the last 5 inches, in a total depth of 20 inches. Similar results may be observed in the case of oats. Five inches of water produced 58 bushels, or 12 bushels per inch; while 20 inches of water produced 86 bushels of oats, which is less than 5 bushels per inch of water. The difference is certainly very striking. Even in the case of potatoes, the yield of which increased steadily with the increase of irrigation water, the same fact holds. Seven and one half inches of water produced 160 bushels, or about 22 bushels per inch; while 30 inches of water produced 274 bushels, which is only about 9 bushels per inch. Mealies, lucerne, the various grasses, sugar beets, vegetables, and all other crops show similar results—namely, *that the value of water is highest when it is used sparingly and carefully; that the value of water is lowest when it is applied liberally and carelessly.* With this generalisation in mind, note how these results may be viewed in their relation to the increase of the irrigated area.

According to the investigations of the Department of Agriculture, under the direction of Dr. Mead and his associates, 30 inches of water, or more, are used in the majority of places in the irrigated districts

for the production of crops. Let us apply the varying value of water as just explained to the economical, or rational, use of water. If the 30 acre inches be spread over 6 acres of wheat, so that the whole area of 6 acres will be covered with water to a depth of 5 inches, each acre will yield 32½ bushels of grain, or a total of 195 bushels. If the same amount of water be spread over 4 acres, that is to a depth of 7½ inches, the total yield of grain will be 165 bushels. Spread over 3 acres, to a depth of 10 inches, the same amount of water will yield 118 bushels. Spread over 2 acres, to a depth of 15 inches, the total yield will be 95 bushels, and spread over one acre, to a depth of 30 inches, the yield will be 42 bushels. It may thus be seen that, in the case of wheat, the total amount of grain produced by 30 acre-inches of water may be increased from 42 bushels to 195 bushels by spreading the water over more or less ground. Certainly the nearly five-fold increase of grain thus made possible will more than pay the farmer for the labour of handling six acres of land instead of one ; and of higher importance is the fact that, *by using the water rationally, the irrigated wheat area may be profitably increased four or five times without building another reservoir or canal.*

These figures show how enormously a farmer can increase the area of land irrigated by a given quantity of water if he understands its scientific use. It is a subject worth studying, for on it depends, to a large extent, the agricultural prosperity of the country. Farm irrigation in South Africa has not received the attention it deserves, and I am looking forward to the time when the Transvaal will have Government Experimental Irrigation Stations in various districts under the superintendence of expert engineers and agriculturists. They will be attended with the most valuable results.

The easiest way in which to see the effect of good and bad methods of irrigation is by means of a sketch or plan. The system usually practised in South Africa is shown in Fig. No. 1.

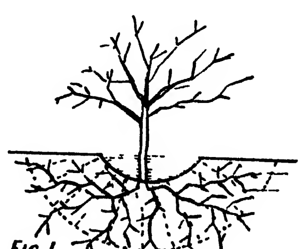


FIG I

The tree is *in* the furrow, and small supplies of water are given every few days. There is not enough to soak deeply into the surrounding soil, and as the roots require moisture they stay near the furrow in the upper layers of the ground. Their approximate position is shown within the dotted semi-circle. All the nourishment in that comparatively small portion of the soil is soon exhausted, and when the water supply gives out the ground rapidly becomes dry and hard.

Then the tree begins to wilt, and frequently dies. I have seen more than half an orchard destroyed in this way. Now, under the proper system of irrigation, the roots should be induced to spread outside the dotted semi-circle. As a rule it is simply a waste of water to irrigate under the branches, and no water is required within the dotted semi-circle for a fully grown tree. The correct method of irrigation is to plough parallel furrows for leading water between the trees. The water should travel slowly, so as to soak three or four feet into the ground, as shown by dotted rays under the furrows in Fig. No. 2.

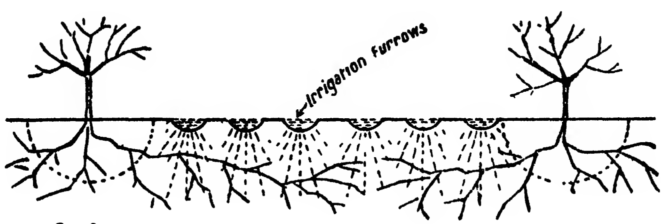


Fig 2

This induces the roots to spread outwards and downwards to get nourishment and moisture, and, when properly rooted, the trees will withstand a severe drought. As soon as the surface is dry enough it should be well harrowed into a fine tilth, which prevents evaporation, and thus holds a far larger amount of moisture in the soil for the use of the plants.

When, however, the water is very scarce I would recommend a new system shown in Fig. No. 3.

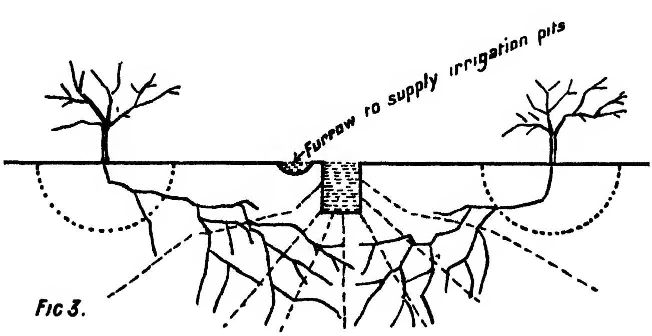


Fig 3.

One or more pits, the size of a post hole, one to two-and-a-half feet deep, should be sunk between each pair of fully grown trees, and the water from the furrow turned into them. The dotted rays show how the water spreads below the surface. The depth, and the distance apart, of the holes will depend on the root system of the trees, the nature of the ground and sub-soil, and the kinds of trees or plants. For

young trees it would be better to have two holes between each pair ; but the holes should always be outside the branches, and when the water begins to sink away slowly, it should be turned off. The holes should be filled with grass, leaves or straw to prevent the sub-soil drying out. The filling when rotten can easily be removed, or fresh holes can be sunk. The surface should be well harrowed to lessen evaporation as much as possible.

By this system the water is applied where it is most needed—*at the roots*—and there is no waste in irrigating the upper layer of soil, one to two feet deep, which contains no roots. If properly grown the roots inside the dotted semi-circles will be hard and woody, and consequently neither require nor absorb moisture. All that work is done in the thread-like tips of the smallest roots. Like all irrigation work, this calls for the exercise of a little judgment. Some orchards may require only one hole for each pair of trees, others two, and others again four holes for each pair. Care must be taken not to get the sub-soil water-logged, for much less water is required by this system that when applied on the surface of the ground. Special care must be observed where there is a gravel sub-soil, lest the water is poured directly into a gravel bed. Permanent holes may be lined with old bricks or drain pipes. Short lengths of large bamboo, with holes cut in the sides, will be found very useful.

RAILWAYS IN AGRICULTURAL DEVELOPMENT.

By Benson P. Wall, M.I.C.E., Chief Engineer, C.S.A.R.

THE following notes are only meant to touch upon some of the problems of railway construction and working, which are likely to be of interest to readers of the "Agricultural Journal," and are not intended to be either exhaustive or too technical.

There are two principal ways in which new projects are initiated, (*a*) by private enterprise, when it is generally the case that the object in view is the profit to be made either in the way of commission for floating a company or underwriting a portion of the capital, or from construction; (*b*) by State Agency when development or pioneering work requires to be done, or when strategic considerations necessitate construction being pushed on.

It is safe to say that 80% of the world's railways to-day represent the results of private enterprise, perfectly legitimate and necessary enterprise which in effect has annihilated distances, political boundaries, and even, to some extent, the influence of protective tariffs. In the first number of the "South African Railway Magazine" will be found a most excellent account of what one firm alone has been able to achieve in the way of developing South Africa by means of railways, and it is probable that if the Cape to Cairo scheme is ever completed the greater portion of the mileage will have been constructed by private enterprise.

In most countries, with the important exceptions of England and the United States of America, Government has, at a comparatively early stage of railway development, stepped in and either obtained control of the system by subsidies, or has virtually introduced State ownership. The reasons for this are not far to seek. In some cases political, or, more strictly speaking, military reasons dictated the course, as, for example, in the Continental States in Europe. In other cases the investing public discovered what is plainly the truth, that railways are only moderately profitable in a direct form for many years after completion, and they refused to finance those which appeared to afford even smaller prospect of a return than the lines connecting important centres, which were naturally taken in hand first. The State, which derived incalculable benefit, even from an unprofitable railway, through improvement in the condition of the community as a whole, and which could afford to wait for a direct return on any outlay, was, therefore, the only agency left for completing the railway system of each country, and State management of railways had to be introduced. The exceptions, of which two have been mentioned, are

usually populous or very thriving States, where the density of traffic is so great between almost any two points that money can usually be found for one or more lines of railway with excellent prospects of early and substantial dividends. It is generally admitted that so far as the countries served by the C.S.A.R. are concerned, railway development has reached such a stage that lines which are non-competitive can only be profitably built by the State, and those which are competitive should not be built at all.

New Construction.—The principle which now holds the first place in the consideration of all new projects for railway construction is that no expenditure over the unavoidable minimum is expedient or justifiable until the revenue to be derived from the district served is ascertained by actual experience. This leads to two important results, namely, (i.) that fixed charges, including interest, which amount to at least 50% of the operating expenses of a branch line are kept down to a minimum, and (ii.) that funds are spread over a greater mileage of new lines. Expenditure which can be postponed without serious loss is not being incurred, and towns which are offended by the wood and iron structures, such as are being provided now, should bear in mind the great benefits that their temporary deprivation of stone buildings is conferring on an equally deserving community elsewhere. It has been said very wisely that the topography of the country, and even financial problems, cannot be reduced to equations and formulæ, and an effort is being made to study each branch line's requirements independently, and to provide all the essentials necessary for dealing with prospective traffic. Waste is being avoided both in spending money on a line whose traffic is an unknown quantity, and in saving money on such a connection as the Brakpan-Witbank Railway, whose traffic can be calculated within a few tons. Rules have, therefore, been framed for a system of light feeder lines, on a standard of which the following is the specification.

Survey.—The steepest, and therefore the ruling gradient, has been fixed at 1 in 40, and it has been ascertained by experiment that the lightest engines at present in use on the C.S.A.R. are capable of dragging seven bogies, each weighing twenty-five tons gross, up such a gradient at fifteen miles an hour. It has been objected that this gradient is too steep for economical working, but against this it should be remembered that none of the trunk lines from Cape ports has a better gradient, and the main line from Durban is not so good, and yet they have all been profitably worked for years. Moreover, it is inconceivable that any of the districts still requiring branch lines will afford as much as one hundred tons net per day, much less sufficient for an engine of greater power that could be run on the line, and it would neither be "expedient nor justifiable" to incur the higher expenditure which an easier gradient would necessitate.

The selected gradient is, of course, only sparingly used, and indeed it is only applied freely in such situations as the fall from the high to the low veld, where it is found to fit the country admirably. All curves

are fully compensated, that is to say, the gradient is reduced or eased according to degree of curvature so that the resistance of the load shall not exceed what it is on a straight bit of ruling gradient. A combination of the gradients and curvature now permissible on branch lines has resulted in many advantages, nearly all in favour of customers. The route, for instance, is considerably shortened, and since all rates, both passenger and goods, vary according to distance (though not in direct ratio) the public clearly gain by shortening the distance between two points. How much this means in rough country may be seen by comparing two surveys run between Krugersdorp and Rustenburg. On a 1 in 80 grade, Hartley's Poort was found to be the only practicable route through the Witwatersberg, and the total distance worked out to 69 miles. On running a 1 in 60 traverse it was discovered that a route down the Doornstroom was feasible with a saving of no less than nine miles in distance. Further, quantities were considerably reduced since ridges, which could not be climbed and had to be cut through on the easier gradient, were easily surmounted or turned by the alignment with a steeper gradient and sharper curvature. A better road bed was secured by keeping formation down on the solid, and this permitted of a cheaper quality and reduced quantity of ballast being used. Against these numerous advantages there are, of course, some disadvantages. The load behind engines is reduced, and working expenses per mile are higher, not so much higher, however, from point to point as to balance the saving on the total distance hauled. Similarly speed is reduced, but not to such a degree as to make the duration of the whole journey any greater. Besides, until a full load for an engine is available, and an extra half-hour in the train becomes of consequence, there is no doubt that the advantages of the steeper gradient far outweigh the disadvantages so far as the interests of the public are concerned.

A good deal more might be written about the principles which should govern selection of alignment, gradients and curvature, but these are applicable to more ideal conditions of railway policy than are at present found in these Colonies. It is infinitely more difficult to decide what should be done in new countries in the way of development, even though it is certain that very few kinds of expenditure will result in loss to the State in the long run. Their physical conditions and commercial possibilities are hardly known, and it is therefore better not to bring in too many factors to complicate the subject.

Works.—It has been mentioned above that formation level is being kept as near the surface of the ground as possible, in order to get the benefit of a solid foundation for the track. Other results obtained are that earthwork quantities are kept as low as possible, and the cost of this item of an estimate is also favourably affected by practically eliminating the harder, and therefore more expensive, kinds of soil or rock from the schedule. During the past two or three years it has been the practice to employ as much white labour as is available on completion of earthworks, and, with hardly an exception, the

engineers in the field report that the class of work turned out is neater and better than is obtainable from contractors, and the cost is not greater. Culverts are now being made of two or three cheap types, pipes of reinforced concrete which are easy to lay, being largely used where moderate provision is necessary, and box culverts of concrete, reinforced with old rails, being employed for larger openings. In the case of bridges, the main stream only is being crossed with large spans and provision for flood water is being made by building approach viaducts of smaller and cheaper spans on each side. The permanent way proper consists of rails weighing 45 lbs. to the yard laid on pressed steel sleepers in situations where white ants are likely to give trouble, and on hard wood sleepers elsewhere.

And here, as this paper is being written for the farming community, a few notes may be appropriately added on the subject of sleeper plantations. During the last three and a half years over 1,000 miles of new railways have been constructed, and about 500 miles of old lines have been relaid in the Transvaal and Orange River Colonies, with sleepers imported from oversea. The number actually laid exceeds three million sleepers, whose price at the ports has averaged five shillings each. Every one of these sleepers might have been produced in these Colonies, and a million pounds sterling would have been distributed among the farmers, or saved by the State in freight charges to foreign administrations. Reporting some years ago, the Conservator of Forests, Kingwilliamstown, made the following calculations to show how a scheme should be worked under the conditions obtaining in that locality. He took the yield of one morgen of forest land at 800 cubic feet of timber which, at 2½ cubic feet per sleeper, would produce 320 sleepers, or roughly, one square mile (302.38 Cape morgen) would supply 100,000 sleepers. Assuming a 40 years' rotation and a demand of half a million sleepers per annum for maintenance and new construction in these Colonies, 200 square miles would produce all the requirements of the C.S.A.R. in perpetuity. This is really not a formidable undertaking for the two Colonies, but let us dismiss the larger question from our minds for a moment, and consider what it means to one individual farmer. One square mile will produce in perpetuity 2,500 sleepers per annum which, at only two shillings, the price at which the State would probably be willing to purchase the timber standing, would mean an assured income of £250 per annum. A farmer who determined to plant only sixteen acres or eight morgen per annum of trees suitable for sleepers could manage it, according to the Conservator's calculation, but, personally, I believe the first yield would come in twenty years. This is, however, a point on which the Agricultural Department could give a more reliable opinion. There is hardly a farmer in South Africa who has not got a square mile of land to spare for growing one or more kinds of sleeper timber. Both hard and soft woods are acceptable, and advice as to the best tree for each locality, with directions as to the best method of planting and a supply of seeds or young plants would be obtainable from headquarters. Being only concerned with the

matter in form of sleepers it may be useful to give a list of the kinds of timber which would be suitable, and from this the particular variety for each farm might be selected. Sleepers have been cut from:—

1. White Oak.
2. Cedar.
3. Longleaf Pine.
4. Soft Pines.
5. Chestnut.
6. Hemlock.
7. Tamarack.
8. Jarrah and other kinds of Eucalyptus.
9. Catalpa Speciosa.
10. Black Locust.
11. Beech.
12. Birch.
13. Sissoo.
14. Teak (Djatti or Tectona grandis).
15. Sâl.
16. Deodâr.

Distance from railway transport need not deter any farmer from starting the experiment, because it is fairly certain that by the time the timber is ready a branch line will exist somewhere in the neighbourhood of the plantation.

Referring once more and briefly to Forestry operations by the State, a visit to the plantation at Pan, on the Delagoa Line, is sure to be interesting and instructive. About two thousand acres are now planted, and the rate of growth of some of the species is extraordinary.

Coming back from this amateur intrusion into the field of another Department there is ample justification for the adoption of the 45 lbs. rails for branch lines. The Heilbron Branch was originally laid with 46½ lbs. rails, which have worn down to something less than our new ones, and are still serviceable for trains at 30 miles an hour, and we believe that the same type was extensively used for main line service from some ports for years. The capacity of the rail is, as a matter of fact, misunderstood, and it is able to carry quite safely at moderate speeds the heaviest engines and vehicles at present in use between Delagoa Bay and Boven. Ballast of the best quality obtainable in a natural state is being used, and is in few cases as poor as was used on the Orange River Colony Lines before they were relaid. Shale, which from the effects of rain and frost soon pulverises, is never used, and gravel or grit mixed with a fair quantity of stone is preferred. Water is being arranged for at or between stations, and pumps are being worked by cheap oil engines as requiring less skilled attention than steam. In regard to buildings, where a fair class of brick is obtainable locally, quarters are being constructed of a permanent character, but offices and goods sheds are being erected of wood and iron. Passenger platforms are, as a rule, made level with the rails, and old sleepers and rails are being utilised for holding up the ramps for loading goods. Signalling is being omitted altogether, but telegraph and telephone services are installed for traffic purposes. Except at stations and around quarters fencing is also omitted. This is perhaps the greatest hardship from a farmer's point of view, but until it becomes necessary to run

night trains there is really no need to go to the expense of fencing branch lines.

The above constitute pretty well all the items of expenditure on light lines, and from the experience already gained it is believed that such railways can be opened for traffic for £2,400 per mile in most districts requiring railways. It is hoped that this figure will not be taken hold of and applied to every line irrespective of the physical features of the country to be traversed, the distance of its main depot from the coast, its proximity to a good labour supply and so on. Each railway is a problem to be studied by itself, and in considering when to build, how to build, or whether to build at all the Engineer is deprived of the valuable aid which is afforded by comparison of similar problems.

Working.—We have in the above considerations dealt only with a railway as a machine, and have had to confess that it is not quite the quality of machine that we would like. We cannot all afford broadcloth and gold lace, however, and we must do the best we can with serge and no frills. A few words remain to be written on railways as a service.

A line such as has been sketched has only two limitations, it cannot take axle loads whether of engines or vehicles of more than 11 tons, and the speed over it must not exceed twenty miles per hour till it has thoroughly well consolidated. If either of these rules is infringed the management or the public may enjoy the transient rapture of having achieved a record of one kind or another, but it is quite safe to predict that the rails will be crippled beyond recovery. It looks like such sound business to spend an extra £500 on a locomotive which will haul as much as two others do at present, that such minor considerations as finding a load for the monster only once a week, and paying the staff for doing nothing the other six days, or the straining of a bridge, or crippling of several miles of rails or crushing the track bodily through the ballast, all at a cost of £500 per mile to rectify, are never remembered.

All the passenger coaches now running on South African Railways are, however, well below the limiting axle load given, and there need, therefore, be no fear that when such become available for branch line service there will be any danger in using them freely. It is hardly probable that there will be sufficient passenger traffic to fill four coaches on a tri-weekly service, and the trains will be made up to about 200 tons gross load behind the engine with goods. Locomotives of the 5th, 6th and 7th class will easily take such loads at a speed of twenty miles per hour, remembering that the ruling gradient is being used sparingly, and is seldom of sufficient length to materially affect the speed.

The service of a branch line is therefore exactly as outlined above. A bi-weekly or tri-weekly mixed train for a 5th class engine to begin with, increasing in load till the capacity of a 7th class engine is reached,

and then increasing in frequency till a daily mixed train is reached. After that a daily passenger and a daily goods train will probably be required, and so on. By the time the rails are worn out a 60 lbs. track and improved ballast will probably be justifiable, on which heavier and more powerful engines will clear both goods and passenger traffic satisfactorily. This is looking ahead a bit, and it may be asked, what are the immediate prospects of such a branch line paying? The answer must be, small or none at all unless that blessed word "Statistics" is brought into play. Statistics and that other mystery, "Rates," can do anything, or at least so we railway men faithfully believe, but this is not the occasion for a discussion on such controversial subjects. For those who like to puzzle over such matters let it be stated that rates are based on no scientific principle, but that bulk, value, origin, destination, route, grades, curvature, average capacity and average load of trains, return loads or empties and a host of other factors which affect the cost of service practically fix rates and send railway men demented.

Plate CLVI

Showing Rack System between Waterval Boven and Waterval Onder.

This fine piece of construction (with a grade of 1 in 20) was completed, under great difficulties, by the Netherlands Railway in 1896.

Plate CLXVI.

Reconstruction of Bridge over Cliphants River.

Cranes lowering girders into position. Train passing along deviation.

NOTES ON ROAD-MAKING.

By T. H. Wessel.

THE aim of these notes is to deal in a cursory manner with the subject of road construction and maintenance as it is now and for many years must continue to be practised in the Transvaal country districts, where supervision, owing to great distances and limited funds, cannot be so thorough and effective as it is in more closely populated countries.

Much has been done in the past to make communication by road between town and country and one district and another easier, but a great deal remains to be accomplished, and the time has arrived when the advantages or otherwise of the various types and sections of road should be carefully weighed against one another. In so doing the climatic conditions of this country must not be lost sight of, and the questions of drainage, formation and treatment of the surface should be dealt with without the fact being overlooked that a long winter's drought may at any moment be followed by a torrential downpour in the spring time of, say, two inches in an hour.

In the countries of Europe, from which most text books on road construction emanate, such conditions are rare, and the necessity for local discussion of their effects and the prevention thereof should prove of especial interest to South African engineers and farmers.

On the other hand, the matter of sub-soil drainage is one which, in the greater part of this country, may be treated as an almost negligible quantity, more particularly where proper provision for the disposal of storm water has been made. The difference between European and African conditions is too obvious to any roadmaker with even the slightest knowledge of both to require further remark, but it would be of the greatest assistance to engineers with South African experience only to have access in public libraries to the various Indian and Algerian writings and records on this subject.

In America, where the construction and maintenance of roads is carried out by local bodies in the various States, the central Government at Washington has found it advisable to establish (under the control of the Secretary for Agriculture) an "Office of Road Enquiry," with a staff of several "Road Experts," who are lent to any State of the Union, which may require their advice and services as supervisors of important works. This office also conducts experiments in the laboratory and the field in order to ascertain the value of different kind of stone as road metal, and it compiles careful statistics thereon.

5

Roadmaking, which at British Schools of Engineering seems to form but a minor part of the curriculum, is thus made the subject of serious study, and the specialist's knowledge there acquired is of a highly theoretical, as well as of an intensely practical, kind. In France also the Department of "Ponts et Chaussees" is manned by specialists who, at the polytechnical colleges and engineering schools, have concentrated their studies on the subject of road and bridge construction.

As the cost of maintenance of a badly constructed metalled road, with inferior stone and subject to heavy traffic is enormous—in some instances the original cost of construction and that of five years' subsequent maintenance may be equal—the public would do well to consider the advisability of using none but the very best materials, and in employing only the best trained men obtainable in the laying down of new roads.

The first cost of a good road is bound to be heavy, and might at first sight to the layman appear prohibitive, but far better it is to spend money wisely on lasting work than to show miles upon miles of unsound and highly perishable roads, such as circumstances too often force the engineer to construct; roads which, for a year or so, gladden the heart of the cyclist, but which later, by reason of washaways, ruts and dust cause him to form a low, and often unjust, opinion of the constructor's abilities.

The following remarks show a few conclusions arrived at by the writer in the course of four years' work in the Transvaal :—

Roads over Level Country or Gentle Slopes.—A few road sections will be discussed, and their merits or demerits pointed out :

Note.—Shaded portion shows formation by soil taken from trenches.

This section of road is one much favoured in Germany, Belgium and Denmark. In these countries, where plains prevail, the trenches are meant more to drain the road bank than as escapes for storm water, and are, therefore, made of uniform dimensions throughout, and of even size on both sides of the road. Such a road is remarkable for its simplicity of construction, and presents the following advantages :—

(1). Owing to the absence of banks between roadway and ditch (as on Fig. 3) all rainwater escapes quickly from the road into the ditch,

Fig 1

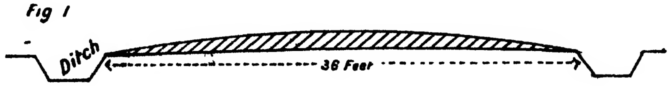


Fig 2

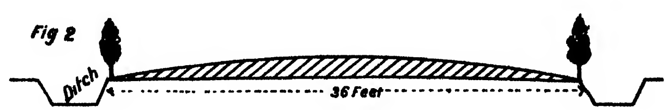


Fig. 3

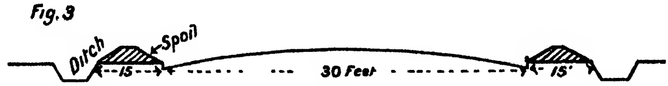


Fig. 4

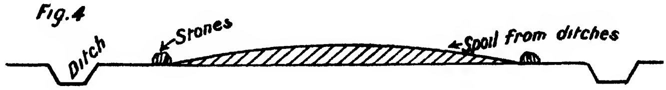


Fig 5

and does not (by accumulating between the *mitre* drains and by flowing for some greater or lesser distance along the road before escaping) acquire sufficient volume or force to scour the road surface to any appreciable extent. On level and incline alike the wide and spacious ditches (in South Africa these should always be spacious, for reasons explained later under "Remarks on Ditches") easily carry all water likely to fall during even the heaviest thunderstorm, and water is not allowed to be the chief factor in the disintegration of the road surface.

(2). All dust formed during the dry season is washed into the ditches by the first heavy rains, and is either carried away into natural watercourses or can easily be removed in bulk from the level stretches where it has settled.

The disadvantage of this section is this, that the ditches abut immediately on to edge of road, whereby accidents might easily be caused, especially in this country, where teams are long, and animals often but partly trained. This might, to some extent, be obviated by planting trees (as on Fig. 2) along the edge of road bank, but this means expense both in planting and—for the first year—in watering.

The road, as shown on Fig 3, is, by reason of the banks between roadway and ditches, safer to travel, but (1) its cost of construction is greater than that of the former; the *spoil* from ditches and cuttings (from centre of road to curb, as well as from mitre drains) must be piled on to the side banks or carted away and cannot be used (as in the case of Fig. 1) for the formation of the road itself. (2) If mitre drains (or "scupper" drains) are not made broad and deep with abrupt fall to ditches gentle rains soon cause them to silt up; thus during storms accumulations of water and consequent washaways will take place in the roadway.

(3). During dry reasons dust accumulates in groin between curb and road and in mitre drains, and becomes consolidated by "couch" or kweekgrass in spring. Banks of turf are formed in this way which are expensive to remove, as well as liable to cause serious damage by keeping storm water pent up in the roadway.

The disadvantages of the former types of road section are not so apparent in those as shown in Figures 4 and 5.

On the section shown as Fig. 4 there is no bank of earth between the ditches and the made ground (taken in most instances from the former) which forms the cambered road. Storm water can thus flow off the cart track anywhere without hindrance, and find its way to the trenches across a bare strip of ground (useful as a footpath) on either side. To prevent vehicles and teams from finding their way into the ditches large stones should be placed, or trees planted, at short intervals along the edge of the track. This road is easy and cheap to construct, given that the soil taken from the trenches is of such a nature that it can be rolled into a firm track. Where this is not the case the cambered surface can be covered with gravel or metal. This seems to be the type of road which best meets the needs of the Transvaal country districts.

Figure 5 shows a modification of above, with the margin outside the roadway cut sloping towards the bottom of the trenches to allow a freer flow for water running from the road towards the ditches, the slope not being too steep for traffic. This work, requiring as it does careful handling, will, of course, increase the expense of forming considerably as compared with that incurred in the construction of the last mentioned road, while the advantages derived are not sufficiently great.

Of the road sections discussed above, that as per Fig. 4 is the one combining most advantages as regards cost of construction, efficiency in use and cheapness in maintenance.

Roads over Sidelong Ground or through Hilly or Mountainous Country.—While a road following a slope (*i.e.* running at right angles to its contours) may be constructed on the same lines as one crossing level country, highways running parallel to or diagonally crossing contours must of necessity be so made that stormwater from the slopes above, whether the catchment of these be great or small, is entirely diverted from the track. There is but one way of doing this, namely, by providing :—

(1). A trench above the road proportionate in its cubic capacity to the size of the catchment area, and

(2). Culverts, proportionate in number and area of cross section to the size and degree of the slope of the catchment area above the road.

(3). It is also necessary on heavy slopes to increase the camber (or crown) of a road to prevent longitudinal scour.

Note.—On heavy slopes the suddenness of the rush of water to and through trenches and culverts is naturally greater than on easier grades. A road constructed along a steep hill with a slope of, say, 1 in 7, therefore (roughly speaking) requires trenches of the same dimensions and culverts at as frequent intervals as one with three times the catchment area above it, but skirting a slope of, say, 1 in 14.

It is not the object of the writer to enter deeply in the subject of the construction of mountain roads, so these will not here be discussed in detail.

Remarks on Road Metalling.—The traffic on most country roads in the Transvaal is not sufficiently heavy to warrant heavy expenditure in metalling. The vicinity of large towns where a number of roads converge, or localities where the nature of the soil is such as to render a road quite impassable during rains, provide an exception to this rule. Where metalling near towns is attempted the authorities would do well in rejecting any proposal to put down any kind of road metal which is not of the very best obtainable, and expert advice on the subject should be sought and taken. Where the scarcity of funds prevents the whole of a bad stretch of road from being properly reconstructed at once, it is better to do a portion thereof, and to gradually add year by year, than to temporarily repair the whole. The filling up of ruts by patches of material of a different nature to the native soil will, almost invariably, result in an uneven surface being formed by traffic or rain-scour, especially if no ditching has been done.

All metal put on a road should be of even quality. To use a mixture of hard and soft stone will quickly result in unevenness of surface, and consequent rapid disintegration. The wear should be uniform. Where a soft metal is used a thicker layer becomes necessary than when harder rock is available.

Much discrimination should be used in selecting material, where the best kinds of rock cannot be had. Some varieties of one kind of soft rock may be almost useless, while others—by virtue of the "binding" qualities usually conferred by the presence of a greater or lesser percentage of iron oxide—may be quite serviceable. This applies specially to ooklip (limonite), a kind of rock which, on account of its frequent occurrence in most localities and easy accessibility, has been much used on country roads in this Colony. Where the better kinds have been put down in sufficient thickness, and where the traffic has not been too heavy, it has stood wear well, but in some instances where the writer has used inferior kinds (*i.e.* those poor in iron oxide) on much frequented roads he has found the results unsatisfactory. It may be accepted as a general rule that the more easily ooklip is got or quarried, the less will it answer its purpose as road metal. There are, however, exceptions, and some kinds of which the basis is argillaceous earth, and which contain very darkly coloured and highly oxidized pebbles, have successfully withstood moderate wear.

Remarks on Trenches.—A highway without adequate protection by trenches is not a road, as it may at any time be made impassable through washaways. It is difficult to overestimate the importance of the trench as a factor in road construction, and where a new road is laid out the protective trench should be the first thought of the maker. Ditches should always be V shaped, or be made with slopes to the bottom of 1 in 1 (45°) at least. This, naturally, does not apply to cuttings in hard rock. On sloping ground much labour may be saved

by grading the size of the cross section from the top to the bottom of the slope or, on sidelong ground, from culvert to culvert. Judgment ripened by experience or that quickness of perception—which is often by persons lacking it libelled as *genius*—will alone, in the absence of elaborate contour surveys, enable a road-builder to estimate the amount of work a stormwater drain may be called upon to perform. In the absence of mature judgment it is best to err on the side of liberality in the size of cross-section, as error in the other direction is apt to cause repeated expenditure of a vexatious and, from an engineering point of view, of a discrediting kind.

These hints may be of some use to farmers engaged in proper husbandry, or even in cattle farming. Where ground has been put under cultivation, or where grazing is of value, it is not economical to allow the veld to become scarred by the continual shifting of tracks year by year as ruts deepen. A single straight road from boundary to homestead, well tended and trenched by the aid of the "Elephant," or a similar plough, and fringed by trees, would, in many cases, save time, trouble, broken axles and valuable horse-flesh, and would add a pleasing dignity to the property. An old Danish proprietor often told the writer that the linden avenue planted during his boyhood by his father consoled him in times of poor harvest, and that the feeling of the crisp gravel of his own roadway under the wheels of his carriage, after jolting over the hard macadam of the main road, gave him at once the cheering sensation of "having got home."

NOTES FROM THE TRANSVAAL MUSEUM.

I. Hints on Collecting Reptiles.

By Lewis Henry Gough, Ph. D., Assistant, Transvaal Museum.

PROBABLY but few of the many visitors who frequent the Transvaal Museum are aware that this Institution has a threefold purpose to serve, and that it is not merely a place of amusement to which one can take relatives and friends coming from the country ; and yet it is so. For, in the first place, every National Museum of this kind is intended to serve as a repository, where representative specimens of the natural history of the country can be stored ; then it is also intended to be the centre of research work on the fauna and flora of the land, and lastly, an educational centre, to spread the results of the work done by providing objects for exhibition which illustrate the results obtained.

The object of this paper is to interest wider circles in the first two purposes which the Museum serves, and to induce them to take part in the collecting of material for examination, and to help to bring together information concerning the living beings, whether animals or plants, which inhabit South Africa, and especially to interest as many as possible to aid the Museum authorities to make as complete a survey as can be done concerning the reptile and frog fauna of the Transvaal.

Until the present year the Museum has been acquiring material to serve as a base for work on the herpetology of South Africa, but it is only recently that these collections have begun to be worked out. And now it has become unfortunately only too apparent that the specimens amassed up to the present, although both numerous and various, are yet not sufficient for the work to be done in the way in which the writer would like to see it accomplished. After having worked through the whole collection of South African snakes in the possession of the Transvaal Museum, it can be stated that over 60 % of the species are represented by specimens. These probably cover almost all the species occurring in the Transvaal, but at the same time they are derived, with few exceptions, from three districts only, from Pretoria, Zoutpansberg and Lydenburg districts.

It is with an aim to complete the herpetological record so as to cover the whole of the Transvaal that this appeal has been written.

The herpetological record is intended to be carried out in such a way that it shall be possible to state the exact distribution in the Transvaal of each species occurring in the country, and also, of course, to know exactly what species are to be found in any one district. Such a record will have great scientific value, as at present no attempt has been made to find out anything of the kind ; without doubt, when completed it will be found to have considerable economic interest also.

Now it is very probable that many persons would be most willing to help the Museum authorities to complete their records of the

national fauna, if they only thought that their help would be appreciated, or if they knew how to do so. Let me assure everyone that any donation of specimens will be most welcome, whether it consists of a single frog, lizard or snake, or of a whole collection, provided that the locality is known from which it comes. And it is of little moment whether the specimens are rarities or whether they are common in the districts where they have been collected; as for our purpose we must have specimens of both, and besides some species may be very common at one place and not to be had elsewhere.

Any parcels labelled "Natural History Specimens," and addressed to the "Director, Transvaal Museum, Pretoria," will be forwarded free by rail or post. Only dead specimens may be sent by post, but the railway accepts living specimens, provided, of course, that they are securely packed.

Now as to the actual collecting; it is hardly to be supposed that anybody will be able to devote much time to it, but even the most busy man would have time to do a little. For instance, how often are snakes killed, and then left lying about to be devoured by the next jackal or secretary bird, and yet most of them would be of value to the Museum, if packed as described below, and sent by rail or post. Of course the less injured a specimen is the more valuable it will be to the Museum. In the case of snakes, for instance, it would matter less if its back were broken than if its head were smashed, an uninjured specimen is however, much more valuable.

In collecting reptiles it can be remembered that 40 % of the snakes found in the Transvaal are innocuous, the rest being more or less poisonous. Of the tortoises, lizards, frogs and toads, none are poisonous, although some of the lizards have the false reputation of being dangerous. When catching lizards, one must always be careful not to hold them by their tails, as most species are able to snap their tails off. Such specimens, of course, lose their value to a great extent, but still would serve to establish a record; the broken off portion of the tail is often wanted to help to facilitate the identification.

Now as to the packing. Collectors living near the railway would best place their specimens in a box, alive preferably, and send them by rail. In this way we have received numerous valuable contributions to our collection, notably from Mr. Bolton, at Kaap Muiden, and from Mr. C. J. Muller, at Vryheid, Natal. Neither of these gentlemen is a professional collector, but yet their contributions have always been of great interest, showing that to obtain specimens it does not want any special training.

People living far from the railway will be dependent on the post for sending their specimens on to the Museum, or will have to keep them until an occasion occurs when they can be sent to the railway. In either case the specimens will be best preserved in alcohol (burning spirit), or in a solution of one part of formaline to twenty-four of water. They can be placed in a bottle, securely corked and packed in a small box and sent by post, or else packed in an ox or sheep bladder with alcohol or formaline, the bladder tied up securely, and sent in a box by

Plate CLXXVI.

The Black Ringhals (*Sepedon haemachates Lacep.*)

Presented to the Museum by Mr. J. J. Cable, Ventersdorp.

The objects on the left are eggs and an embryo taken out of this specimen

post. Should the distance by post from Pretoria not be more than twenty-four hours, the specimens might be sent dead, simply in a box, without alcohol or other preservative.

Snake-skins are of very little use or interest. In most cases they can hardly be identified, and usually they are stretched to more than twice their original size.

Every specimen should be accompanied by a label, stating the date and locality of capture, the local name when known, and the name of the giver. In the case of snakes the local names will be of some interest, as very many seem to be called by the same name. Thus there seems to be considerable uncertainty as to what snake should be called the Mamba. I have received specimens of seven different species all titled "Mamba" by the captors, of which five were harmless and one comparatively innocuous, the seventh is very poisonous and extremely rare. Yet everybody knows the Mamba to be very poisonous, and in some places to be reputed to be common. The Puff Adder and Night Adder seem to be the only species whose names are reserved for them alone.

When sending live snakes by rail it is particularly requested to place a label "live snakes" on the box, and not to trust to a letter. Thus I have already received a living poisonous snake sent by rail two days before the accompanying letter marked "urgent," both having been despatched by the same train!

It may be of interest to the general public to know what happens to specimens presented to the Museum. In the first place it is entered in the day-book, receiving a number. Then it is entered on a card catalogue, on a card having the heading of the species to which it belongs, then a label is attached to it having the full information as to species, locality, date, collector and number, as on the cards or in the day-book. Then, if the specimen is suitable for exhibit, and of a species not yet on show, it will be mounted and put in its proper place in the public exhibit gallery. Otherwise it comes into the store-collection, which is not usually shown to the public. A letter of thanks is then sent to the donor, stating, when possible, the name of the species presented.

In conclusion, let it be said that the Museum staff are always willing to answer any enquiries about subjects concerning the departments under their charge, or, upon application, to show the store (or scientific) collections to those particularly interested in them.

It is intended in a future number of this "Journal" to give a list of the snakes of the Transvaal, with the necessary illustrations and descriptions, to enable farmers to distinguish between the dangerous and harmless species; and if the material at our disposal permits, also the localities where they are to be found, and notes on their habits and food.

The plate shown represents a Black Ringhals (*Sepedon haemachates*, Lacep.), presented to the Museum by Mr. J. J. Cable, Ventersdorp. The specimen was sent here by rail in a tin; the objects on the left are eggs, and an embryo taken out of this specimen. It is possibly the largest specimen known, being 3 feet, 11½ inches long.

THE VETERINARY SECTION.

VETERINARY HYGIENIC PRINCIPLES APPLICABLE TO STOCK IN SOUTH AFRICA.

By Dr. Arnold Theiler, Government Veterinary Bacteriologist,
AND
C. E. Gray, M.R.C.V.S., Principal Veterinary Surgeon.

(*Continued.*)

Diseases of Stock not Referred to in the Contagious Diseases Animals Act.

The diseases which have been dealt with in the previous parts of this article are constantly a serious menace to agriculture, transport and trade, and consequently to the welfare of any country whose industries largely depend on the rearing of stock. With a few exceptions they are of such a nature that the individual stock owner is hardly able to protect himself against them effectively, and it is therefore a duty of the State to step in and assist him. Besides the aforementioned diseases, there are many other contagious and infectious diseases which, for various reasons, are not considered by the Legislature. For instance, some of the contagious diseases are not considered to be of a sufficiently deadly character to warrant any interference, *e.g.*, contagious pleuro pneumonia of equines, strangles, etc.; others are of such rare occurrance that their economic importance is relatively small, *e.g.*, actinomycosis, tetanus and pustular stomatitis; a third class are of such a nature that no State control could be possible, *e.g.*, horse sickness, biliary fever, osteoporosis, blue tongue, jagziekte in sheep, heartwater and gylziekte.

On the other hand there are diseases not mentioned in our Animals Diseases Ordinance, which appear amongst the scheduled diseases of other countries, *e.g.*, quarter evil—whilst in South Africa, at the present time, diseases have made their appearance which were previously unknown, and which are of such a character that a layman cannot be expected to know how to protect himself against them. This latter class must become the subject of legislature in time to come, and under this heading we may mention periodic opthalmia of horses, contagious gangrenous dermatitis of the heels of donkeys. So far our knowledge regarding the cause of these diseases, viz., the nature of the virus and propagation, is very small, consequently drastic application of legislative measures at the present time, which were not based on well founded principles, might be futile. There is, however, no reason why a buyer of stock should not be protected against damage caused by stock invisibly infected by any of the mentioned diseases.

Up to the present we have been principally dealing with diseases which are clinically well defined and characterised by certain symptoms

which are sufficiently diagnostic. In addition to these, we may consider constitutional derangements caused by intestinal parasites which do not produce symptoms of a sufficiently distinctive character to enable us to determine their cause with certainty, but which are the cause of much loss to stock owners. These may be discussed from a hygienic point of view, and may be considered together, since the general preventive measures applied against them are based on a knowledge of the life history of the causal parasites, which have many features in common.

We now propose to discuss the principles of preventive treatment, which we deduct from our knowledge of the etiology of the various diseases, seriatim in connection with the more formidable diseases and collectively for those which can be grouped together. We shall accordingly treat of the diseases affecting (1) equines, (2) bovines, (3) sheep and goats, and (4) parasitic diseases of stock in general.

1.—DISEASES OF EQUINES.

Horse Sickness.

This is the most formidable disease of the horse, not only in South Africa, but all along East Africa up to the shores of the Red Sea ; we know of its existence in Western Africa as far as the Congo, and it can be assumed that it is distributed over the greater part of Africa.

It is not our intention to describe the symptoms and lesions of horse sickness, which are more or less familiar to everyone dealing with horses in South Africa. It should first be mentioned that the diseases of the horse known as dikkop, dunkop and blue tongue are identical and due to the same cause, and the causal agent, whatever it may be, is abundantly present in the blood. This is undoubtedly a micro-organism which, however, is so small that it cannot be detected with the highest power of the microscope, and which passes readily through the very fine pores of a porcelain filter. If we take the blood of a sick horse and inject it into susceptible horses, we produce the disease, which may either appear in the form of dikkop or dunkop, no certain forecast of the form which it will assume being possible, and it therefore follows that when an animal has resisted an attack of the disease in one of these forms that it has also become immune against the other. Although the blood of a sick horse usually conveys the disease to susceptible horses, yet the disease is by no means contagious in the strictest sense of the word. That is to say, a horse suffering from horse sickness may be brought into a stable of healthy ones without communicating the disease to the latter. It has even been observed that the discharge from the nose of a sick horse on to food in the manger has been eaten by other horses without causing any damage whatever. This would help to show that the secretions of an infected animal do not cause the disease when taken up by the mouth, although the same matter emanating from the nose will produce the disease when injected under the skin, and therefore we may conclude that it is not by way of the digestive tract that the disease is propagated under natural con-

ditions. For some considerable time, probably as long as horses were in South Africa, it has been noted that horse sickness appears only at a certain season of the year, and again in particular localities, where it is recurrent under more or less similar conditions. Regarding the condition of locality, it is known that low lying spots, river beds and swamps are more dangerous than higher situated parts, that is to say, the higher a locality is situated, the less horse sickness appears. It must be understood that the height of a locality above sea level is no guarantee that it is free from horse sickness, but it is rather its relative elevation above the surrounding district. The time at which horse sickness appears annually in those districts in which it is prevalent depends largely upon rainfall and temperature. It is an old saying that "the earlier the rain the earlier the horse sickness," and for some time it has been noted that the warmer a locality the more unhealthy it is for horses ; hence bush and low veld have become notorious for horse sickness. Thus we note that this disease usually commences at the end of December, but is most prevalent during the months of February, March and April. The onset of the cold season puts a sudden stop to the epidemic of horse sickness, and previous observations show that the disease disappears eight days after frost. This observation means, in other words, that the frost in some way checks the spread of infection. The disappearance of the disease in this way, eight days after frost, may be assumed to indicate that this is the average incubation time for the development of the disease, and this latter observation has been confirmed by the inoculation in practice, but the assumption that the frost kills the cause of the disease, that is to say, the micro-organism which produces it, is not, however, correct. We have experimentally proved that infective material can be kept in the ice box for several years without losing its virulence.

It was formerly considered that dew is responsible for this disease, on the grounds that the horses turned out to grass laden with heavy dew fell an easy prey to horse sickness ; for this reason it has also been noted that horses kept in stable are less susceptible to the disease than those which were turned out to graze, and it is a well-known fact that a stable affords protection to horses. It now remains to discuss all these observations, and to see whether they stand a scientific criticism.

The observation that horse sickness is prevalent amongst animals grazing in the heavy dew is undoubtedly correct, but, at the same time, if the heavy due causes the disease we should be able to produce it artificially by drenching horses with this matter, or by injecting the same dew under the skin. On many occasions we have experimented on these lines, but failed in every case to produce the disease, thereby proving that the virus of horse sickness is not present therein, and that dew is not responsible for the disease. It must also be remembered that although dew is distributed over the whole world, horse sickness is only known in Africa. It must therefore be another agency which is more likely to be present during the presence of the dew than at other times. We are able to produce the disease by a subcutaneous (under the skin) injection of one drop of horse sickness blood, and yet it is practically

impossible to obtain a similar result by giving one thousand times this quantity of the same virus through the mouth. It may, therefore, be inferred that under natural conditions the infecting agent is probably introduced underneath the skin, and accordingly we have to discover an agency which will transmit the disease from one animal to another under these conditions. That a blood sucking night flying insect might serve as the infecting agent, such, for instance, as a mosquito, is obvious, and we know that the conditions of temperature and climate largely influence the distribution of these insects. Human malaria is a very good example of such a mosquito borne disease, but although mosquitos are very widely distributed, human malaria is only prevalent in particular localities in which certain conditions of temperature obtain, which leads us to the conclusion that it is not every variety of mosquito that is capable of conveying malarial infection, and that even where the special varieties of malaria conveying mosquitos are found that the organism of malaria can only thrive and multiply in the body of the mosquito under the favourable condition of an optimum temperature, and this is probably also the case in horse sickness.

With regard to the annual appearance of horse sickness, the earlier we get rain the sooner mosquitos appear, because during the first stage of their life cycle, the larval and nymphal mosquitos depend entirely on water, therefore the more water obtainable the more abundant these insects will become, and the sooner horse sickness makes its appearance, which suggests a possible connection between the appearance of the mosquito and the appearance of the disease, as the mosquito theory explains all the many facts which otherwise would be shrouded in conjecture. For instance, it explains why horse sickness may be observed in a good stable just as well as a bad one ; why the disease is not so frequently observed in high altitudes as in low ones, and, finally, why the disease disappears suddenly after a heavy frost.

It has often been asked that if mosquitos are really the carriers of horse sickness, why, as they prefer indoor life, is the disease not more frequently encountered in stables. Careful investigations have shown that mosquitos are very rarely found in stables. Experiments made with a view to feeding mosquitos on stabled horses have resulted in failures. There seems to be some active medium in the stable which is disliked by these insects, and we are justified in saying that the fumes of ammonia, given off by decomposing urine in stables, are probably responsible for their absence ; another fact which seems to confirm this theory is that horses living outside are more readily bitten by mosquitos than those kept in stables. The theory of the propagation of horse sickness by mosquitos from one season to another by a transmission from horse to horse of the virus of the disease is open to some objections, which at first sight appear somewhat difficult to explain. It may be asked if the disease is carried by mosquitos which are killed by frost, how is it that the disease reappears season after season, and how is it that mosquitos can communicate the disease to horses brought into localities in which no horses have been for years previously. The first objection is obviously answered by pointing out

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With regard to the annual appearance of horse sickness, the earlier we get rain the sooner mosquitos appear, because during the first stage of their life cycle, the larval and nymphal mosquitos depend entirely on water, therefore the more water obtainable the more abundant these insects will become, and the sooner horse sickness makes its appearance, which suggests a possible connection between the appearance of the mosquito and the appearance of the disease, as the mosquito theory explains all the many facts which otherwise would be shrouded in conjecture. For instance, it explains why horse sickness may be observed in a good stable just as well as a bad one ; why the disease is not so frequently observed in high altitudes as in low ones, and, finally, why the disease disappears suddenly after a heavy frost.

It has often been asked that if mosquitos are really the carriers of horse sickness, why, as they prefer indoor life, is the disease not more frequently encountered in stables. Careful investigations have shown that mosquitos are very rarely found in stables. Experiments made with a view to feeding mosquitos on stabled horses have resulted in failures. There seems to be some active medium in the stable which is disliked by these insects, and we are justified in saying that the fumes of ammonia, given off by decomposing urine in stables, are probably responsible for their absence ; another fact which seems to confirm this theory is that horses living outside are more readily bitten by mosquitos than those kept in stables. The theory of the propagation of horse sickness by mosquitos from one season to another by a transmission from horse to horse of the virus of the disease is open to some objections, which at first sight appear somewhat difficult to explain. It may be asked if the disease is carried by mosquitos which are killed by frost, how is it that the disease reappears season after season, and how is it that mosquitos can communicate the disease to horses brought into localities in which no horses have been for years previously. The first objection is obviously answered by pointing out

that infected mosquitos may survive in a dormant condition in sheltered localities, and may start the disease the following season, while the second difficulty, which lies in the way of our accepting the mosquito theory, may be overcome if we assume that some other species of animal besides the horse, suffer from the disease, and in this way mosquitos may become infected which have never come in contact with equines at all, indeed an observation of certain facts leads us to believe that it is very likely that other animals may perpetuate infection in the absence of horses. An injection of dogs and goats with horse sickness virus has been followed in some instances by the development of the disease ; the former die from it, but the latter recover. What may be done under artificial conditions may confidently be expected to occur under natural conditions, and the theory that other animals besides horses acquire horse sickness seems to be very feasible. Although these theoretical deductions are not completely supported by experimental proof, still they assist us in suggesting precautions which may be taken to protect our equines from infection. The general practice of keeping horses in doors after sunset and before sunrise, is a sound one, as it protects them from the attacks of blood sucking insects. We have seen that stable protection is to a certain extent reliable, and the reason has been explained, but it is also known that in very bad horse sickness years the protection afforded by ordinary stables is occasionally insufficient. We can therefore improve on this protection by making our stables insect proof, and if the mosquito theory is correct, insect proof stables ought to protect animals completely from horse sickness, and in cases where it is impossible to make a stable thoroughly insect proof, if we can render the atmosphere of the stable obnoxious to mosquito life, we increase the security of the horse. Mr. Pitchford, of Natal, has demonstrated that horses kept in the worst horse sickness country do not contract the disease when kept in an insect proof cage. He has further demonstrated that horses kept in a stable which is constantly smoked obtain a great amount of protection, and for several years this procedure has been carried out in various parts of South Africa with great success. For this purpose it is advisable to make a smouldering fire alongside the stable ; the smoke is let into it by means of a pipe ; or another method quite as effective is to keep a smouldering fire at the door of the stable, of course, under such conditions that no danger could accrue to the animals, for instance, by burning manure in a paraffin or iron tin. The objections to this method are, unfortunately, numerous, particularly in the case of a traveller who would be unable to carry out this recommendation owing to the absence of a stable, and in districts where owners have to depend largely upon native labour the method does not forcibly recommend itself, therefore it is quite natural to desire a better method of protection. This can only be obtained by rendering an animal immune, that is to say, by passing him through an attack of the disease so that no biting flies or insects can subsequently infect it. For a long time it has been known that an animal which has recovered from horse sickness is immune, or what is commonly known as "salted." It has further been observed that immune horses can be exposed to all conditions of climate, with but little danger of contracting

horse sickness, although it must be remembered that salted animals may contract horse sickness a second time. This fact has particularly been observed to be the case when a horse which has salted in one part of the country is transported to another district, although certain localities are known in this country of which it is said that when a horse is salted there, it will be immune for the remainder of the country. We shall again refer to this fact later on.

The fact that rendering an animal immune gives him a certain protection has served as a basis for the inoculation against this disease, which was introduced into practice over a year ago, and we are now able to immunise mules against horse sickness by a simultaneous inoculation of serum and virus, but we have not yet been able to apply the same method with equally successful results to horses. It seems that the mule, although as susceptible to the disease as the horse, more quickly recovers than the latter, and it is evident that the factor which helps him is due to some inherited power of resistance transmitted by his sire, who, as we know, although susceptible to horse sickness, very seldom dies from it.

This method of inoculation has been applied during the last year to some 3,000 mules in all parts of the Transvaal and Rhodesia. The results have been very satisfactory, and total loss from the inoculation having only amounted to 3.8%. We have every reason to believe that it will be possible to improve this inoculation at some further period, and also to reduce the mortality to almost nil.

Since the introduction of this method, horse sickness has been very virulent in various parts of the country, and our mules have stood a very severe test, with the result that only .6% of the immunised mules again contracted horse sickness. The fact has been the starting point of a new series of experiments, which have confirmed the observation that animals may contract horse sickness more than once, and the so-called "aanmaning," or relapse of a healthy horse or mule, is no longer a doubtful phenomenon. Various strains of horse sickness virus have been collected, but experiments have been made more especially with three, and the fact remains that equines, although immune against horse sickness, may be reinfected twice, three times, or even more. We are not able to break down the immunity of a mule or horse by the infection of such enormous quantities of virus into its system as is necessary to kill 10,000 horses, provided that the virus used in the test injection is of the same kind against which the animal was immunised ; yet we are able to overcome the immunity with a comparatively small quantity when the virus is of a different strain. There are accordingly in South Africa various strains of virus of horse sickness, all of which are similar to each other, but differ in the respect that immunity obtained from one strain does not protect against another strain. This explains the varying virulence of the disease of different districts and localities, and is of great importance, and the discovery of this fact was a severe set back to our work, because we find it is necessary to devise a method of immunisation which will protect animals against all strains of virus, a task which hitherto we have not been able to accomplish completely,

but as only .6% of mules have died in practice after inoculation, it seems that our virus is probably of the type which is most common in the Transvaal, although there may be certain strains against which our virus may not be strong enough to protect, therefore our method of immunisation will only be perfect when we are able to protect animals against all the different virus encountered in South Africa. Meanwhile we are continuing to immunise with the strain of virus which is most commonly found.

The application of the inoculation lies in the hands of the various Government Veterinary Surgeons, and although the conditions are probably familiar to the majority of farmers, the following extract may prove useful :—

Extract from Government Notice No. 1014 of 1905.

Owners of mules desirous of having them immunised against horse sickness are requested to make application to the District Veterinary Surgeon at any of the following towns, giving particulars of the number of animals which they intend bringing forward for treatment : Barberton, Krugersdorp, Lydenburg, Middelburg, Piet Retief, Potchefstroom, Pretoria, Rustenburg, Nylstroom, Zeerust, Pietersburg, Mbabane (Swaziland), Heidelberg and Ermelo.

A charge of 30 shillings per head will be made for each animal immunised, and compensation will be paid for any animal dying as a result of inoculation while under treatment, according to a valuation fixed by the District Veterinary Surgeon, which will not exceed £15 per animal, and which will only be paid providing certain conditions imposed by the District Veterinary Surgeon are duly complied with.

Animals to be immunised must be brought into town for treatment, and owners are expected to make their own arrangements for accommodating, feeding and attending to animals while under treatment, or if the animals are received into a Government depot, where such is established, they will be called upon to pay the actual cost of feeding and attendance.

The average percentage of mortality amongst animals inoculated so far has been between 3% and 5%.

Animals immunised will be under treatment for about three weeks, during which period they cannot be worked.

Where animals belonging to different owners are brought together for immunisation, the District Veterinary Surgeon may test them all with mallein, should he consider this advisable before proceeding to immunise, in order to exclude any animal which had been exposed to glanders infection, and which might act as a centre for the spread of the disease.

The malleining of these animals will be carried out free of charge.

The District Veterinary Surgeons have been asked to meet the wishes of farmers as far as possible by inoculating animals whenever required to do so if they can do so without interfering with the carrying out of their official duties in connection with the suppression of contagious disease.

Biliary Fever.

This is a disease which has first been described in horses in South Africa, but subsequently discovered in Egypt, and is probably encountered all over Africa ; it has also been traced in India and Italy, and is likely to be found in other countries. Horses, mules and donkeys are susceptible to this disease, which is most serious in imported equines and in animals bred and kept in the stable. We shall later give an explanation for the reason of this observation.

The South African horse, born and bred in the veld, is not susceptible to this disease, or at least only to a very small extent, and under particular conditions. The name biliary fever is derived from the yellow discolouration of the mucous membranes, and occasionally of a similar discolouration of the urine. The disease is very little known by South African farmers, who, as a rule, deal only with country bred horses, and even when it is observed he probably mistakes it for horse sickness, as some of the symptoms are identical. The yellow discolouration of the mucous membrane of the eye forms, however, a characteristic distinction from horse sickness, where either no discolouration, or perhaps a dark red discolouration of the mucous membrane of the eye takes place. Sometimes, however, both diseases are met with together. Biliary fever is a blood disease caused by a small parasite belonging to the animal kingdom which lives inside the red corpuscles of equines. This parasite produces some poison which affects and destroys the red corpuscles so that the number of corpuscles are decreased from one-third to one-fifth, and sometimes even less. In other words, there is an enormous loss of this important constituent of the blood. This breaking down of the red corpuscles is responsible for all the symptoms during life, and for the appearances found on post mortem. Under ordinary circumstances one of the functions of the liver is to break up the colouring matter of the blood set free by the destruction of the red corpuscles. This is done by producing bile, but in cases of biliary fever an enormous over-production takes place which cannot be readily discharged, and hence a re-absorbtion into the blood again follows. The bile stain is now washed all over the body, and stains the tissues yellow. Part of the corpuscles are retained by the spleen, and consequently on post mortem we find that this latter organ is greatly enlarged. When the dissolution of the red corpuscles has taken place rapidly, we often notice a red discolouration of the urine, and the animal might be said to be suffering from redwater. There is, indeed, more than this one point of resemblance between biliary fever of horses and redwater of cattle. We may say that both diseases are closely allied, although not identical, and indeed they have more or less identical characteristics. Thus a horse recovered from an attack of biliary fever constantly retains the infection in its blood. We can usually prove this by the injection of blood of an immune horse into freshly imported horses, mules or donkeys, when the disease will be promptly produced.

From the above-mentioned analogy, we were entitled to conclude that biliary fever is probably propagated in the same way as redwater,

and experiments have proved that such is the case, but whereas ordinary redwater is propagated by the common blue tick, biliary fever, so far, could only be transmitted by the red tick. We know that the infection in redwater passes from the adult mother tick, through the egg into the larvae and is communicated by the latter. The red legged tick, so far as we have proved, takes the infection in the nymphal stage and communicates the disease as an adult. As yet we have no proof that it goes through the egg and is transmitted by the larvae. Further experiments will be necessary to elucidate this point, but the fact remains that biliary fever is a tick borne disease. It must be remembered that a tick is equally able to infect itself by feeding either on a sick or immune horse, as we have shewn that the blood of the latter remains infective. Thus any animal born in South Africa, and exposed to the veld will become infected with ticks, and just as is the case in redwater where young calves contract the disease and usually recover, without shewing any lesions, so do foals contract biliary fever and recover, shewing only temperature reactions. On the veld all ticks constantly infect animals and *vice versâ*, therefore the immunity of the South African born horse is kept permanent, and perhaps increased by continued tick infection. We have stated that foals do not die of the disease, and although the reason is not quite clear, it may be anticipated that in a foal the regeneration of the red corpuscles is more active than in an adult horse, so that the loss of blood caused by the presence of these parasites is constantly replaced. Imported horses and adult horses grown up in a stable, when infected with this disease, probably suffer more severely, because the regeneration fails to keep pace with the destruction of the red corpuscles.

Upon these observations and deductions practical measures for the protection of animals may be based. In the first instance it will be advisable to make a horse immune against the disease by exposing him to the veld whilst a foal, when he will become tick infected, and subsequently immune. This method of conferring immunity cannot be applied to imported horses without considerable risk, but it has been found that adult mules and donkeys, which are susceptible to the disease, can be immunised by inoculation with blood of an animal which has recovered, or which was born in the country. The result is that with an incubation time from about 7 to 12 days a fever appears, during which the typical piroplasms are found in the blood. Following the conclusion of this primary reaction, a second relapse usually occurs shewing the same lesions as the first one, and as both attacks are complicated by the destruction of red corpuscles, it is necessary to keep animals inoculated according to this method in the best of conditions, that is to say inoculation should not be made during the winter unless a good supply of succulent food is possible, but at the beginning of summer when there is plenty of grass at hand this method cannot be safely applied to horses.

The fact that biliary fever is a tick borne disease suggests that the best preventive measures against this disease would be to destroy the ticks ; in other words, that dipping animals intended for breeding purposes would probably keep the infection away. This is undoubtedly a

fallacy, as no known dip protects an animal from fresh attacks of ticks, even if used sufficiently strong to kill all ticks on the animal at the time of dipping, and therefore dipping will not prevent the development of the disease in susceptible animals. It is true, however, that by constantly dipping over a long period, ticks on a farm may be completely eradicated so that biliary fever will no longer be transmitted, but by so doing we deprive the foals of their opportunity of being naturally inoculated against the disease, and since the destruction of ticks throughout the country is impossible, such an undertaking would mean that horses reared under such conditions would contract biliary fever when removed elsewhere. It may be mentioned, as a matter of interest, that we have found that the zebra, as well as immune horses, mules and donkeys, also assist in perpetuating biliary fever infection.

Bearing all these facts in mind, it will be advisable for the importer of equines to obtain them young as possible, as we have noted that foals more often recover from this disease than adults.

On account of the prevalence of biliary fever in South Africa the importation of stallions for breeding purposes is usually attended with unsatisfactory results, as in the majority of cases the stallions are mixed with the mares and turned into the veld. The stallion may cover a few mares before he becomes infected, but before he has been running on the veld for long he contracts biliary fever, and either dies of it, or in consequence of the length of its convalescence is quite useless for some considerable period.

It has already been stated that at present we are unable to render stallions immune against this disease, and we therefore recommend some slight alteration in the present habit, by keeping the stallions in stables and turning them on to the mares at the period when ticks are not very frequent, that is, during or at the end of the winter.

Osteoporosis.

This disease is characterised by a softening of all the bones of the body, which is indicated by their predisposition to fracture, and also by a swelling of the facial bones and bones of the joints. This softening of the bones sometimes causes an early detachment of the ligaments, and, consequently, the animal shews signs of lameness, and in its earliest stages, before any visible alteration of the bones of the face or limbs become marked, osteoporosis is frequently mistaken for rheumatism.

This fragility and softening of the bones is due to a change in the proportion and deficiency in the amount of certain lime salts, and Mr. Ingle, Chief Chemist, Agricultural Department, who has analysed a number of bones from horses, mules and donkeys suffering from osteoporosis in this country, reports that his analysis confirms this fact, but whilst there is no doubt about the scarcity of phosphates in the diseased bones, yet it is a difficult matter to assign the reason for it, although a series of observations have been made which seem to point to the fact that osteoporosis may be due to some micro-organism. There are probably various causes, and the disease observed in Europe—where

it is not frequently encountered—may be due to a different cause to that producing it in South Africa.

In this country the disease is principally present in large towns; it was first noticed by Dr. Hutcheon, in Port Elizabeth, and subsequently it was found in Johannesburg. For some years it has been very prevalent in Capetown and Kimberley. There seems to be some connection between the importation of the first sick horse and the subsequent propagation of the disease. This has clearly been proved to be the case in Capetown, where, in former times, osteoporosis was unknown, but where it is now a real curse to horse-flesh. The disease is also very common in Johannesburg, and it is noticeable that it is usually the well-bred and race horses which are chiefly affected. The peculiar fact in connection with this disease is that horses in the best condition, well fed and well stabled, more often suffer than the poorly fed animals. Therefore the suggestion that the deficiency of phosphates in the food is responsible for the disease cannot hold good. Moreover, if such was the case it is only natural to expect that cattle fed in the same way would also shew osteoporosis, but hitherto this has not been the case. There is another fact which is worthy of mentioning, namely, that the food which is supplied to Johannesburg is brought from farms on which horses are kept, fed with similar food, and yet these animals do not suffer from the disease. This suggests that the disease is not due purely to dietetic causes, but that certain local conditions in Johannesburg are favourable to its propagation. Analysis of the water of that particular town shows that it cannot be held responsible for the disease, and this also holds good for Capetown and Port Elizabeth and other localities where osteoporosis is prevalent.

All observations seem to show that the disease is imported into a stable, and that it remains there. It has frequently been noticed that cases of osteoporosis are often found in certain stables, but although this fact allows us to regard such a stable as infected, we have some difficulty in explaining why there are only certain localities where this disease is prevalent—for instance, if the disease is infectious why has it not been noticed in stables in Pretoria, where, during the last 15 years, a great number of horses suffering from osteoporosis have been brought from Johannesburg? This observation would appear to indicate that the condition which is necessary for the propagation of the disease is absent in Pretoria. We would explain this fact by suggesting an intermediate host. It must be mentioned here that microscopical examinations of blood of a horse suffering from osteoporosis show no micro-organism to be present, and the injection of blood from a sick into a healthy animal has never produced the disease.

Notwithstanding all these facts we know by analogy that the disease in question is one which may be transmitted by intermediate hosts. We have only to refer to heartwater, where the micro-organism is not visible, and to East Coast fever, which cannot be inoculated by blood, yet both diseases are transmitted by ticks. It is, therefore, possible that some invisible micro-organism may act as the cause, and may require an intermediate host for its propagation.

For the present, therefore, and until we have more knowledge regarding the disease, it is advisable to consider it as contagious, and to take such precautions as are adopted in similar cases; therefore, stables in which osteoporosis is present should be thoroughly disinfected at short intervals, and if in this way the disease cannot be suppressed, it is advisable to discontinue the use of such a stable and erect a new one. It has frequently been noted that horses suffering from an attack of osteoporosis recover when brought under new conditions, therefore the removal of affected horses to a farm is advisable. More definite instructions than these cannot be given until the real cause of the disease is ascertained.

Gangrenous Dermatitis of the Heels of Donkeys.

A common name for this disease is "contagious greasy heels," or, as it is vulgarly known, "foot-rot." In its earliest stage the symptoms are those of an ordinary greasy heel, which has very little tendency to heal, and which continues to extend until there is complete destruction of the skin of the heel around the coronary band of the hoof. It then extends upwards to the fetlock, and may involve the region of the tendons. The disease may affect either the fore or the hind legs, or even all four, and sometimes the inflammation has been noted to travel along the skin of the stomach. The disease was first observed at the time of the rinderpest in 1897, when large numbers of donkeys were imported into South Africa to replace the ox transport. It is highly contagious, and usually affects all the donkeys of one span.

The infection appeared to remain on the transport road over which the donkeys travelled, because it was noticed that the majority of the animals which passed along that road became infected. It was not observed in horses or mules, although the latter were frequently used at the same time and in the same span as the donkeys.

The disease is undoubtedly contagious, but we have not been able to trace the particular micro-organism to which the infection is due, neither are we certain of the way in which the disease is communicated from one animal to another.

Observations made in Rhodesia, where about 18 months ago a new outbreak occurred, seem to point to the fact that ticks cause a primary lesion in which the infection may establish itself, and even that the tick may be the carrier of the infection.

During the last few years we have not noted this disease in the Transvaal. It is not included in the "Contagious Diseases Act," but we should have no hesitation in recommending it to be scheduled as such, in the event of a fresh outbreak occurring in this country. The lesions caused by it are so serious, and the damage so great, that in order to protect the community against severe losses, such a procedure is perfectly warranted.

The first duty of anyone who observes this disease will, therefore, be to immediately notify the proper authorities.

PERIODIC OPTHALMIA.

This is a disease of the eye, which, as a rule, is of a relapsing character ; in other words, the animal may recover for the time being, but some weeks later the disease reappears, and usually recurs until the eye is finally opaque and atrophied. At this stage it is noticeable that in addition to the complete blindness the eye-ball of the affected eye is smaller than that of the healthy one. The symptoms vary according to the age of the disease ; therefore the first attack is the most severe ; the latter ones are milder. Many chronic lesions found in blind eyes can frequently be traced to an attack of periodic opthalmia. The diagnosis by a layman is somewhat difficult, and it requires expert knowledge to decide that a lesion of the eye has been caused by opthalmia.

The disease has been frequently met with since the war, and at the present time there are a large number of horses blind in one or both eyes, which have suffered from the disease. It has been noted that imported horses are the chief sufferers from opthalmia, but occasionally South African horses have been similarly affected ; in other words, it would seem that the disease is one which was formerly absent from this country, and that South African horses are susceptible.

The cause of this opthalmia is unknown. We have tried to transmit it from sick to healthy horses by the inoculation of diseased matter of the affected eye into the eye of the healthy animal by piercing the cornea and injecting the diseased material into the frontal chamber. Within the first 24 hours lesions of an inflammation made an appearance, but they quickly disappeared ; the eye remained healthy, and no relapse occurred. Notwithstanding this failure, the history of the disease, especially the conditions under which it was encountered in other parts of the world, point to the assumption of some micro-organism as the cause. It has been noted that peculiar conditions of the soil are required—for instance, the disease is more frequently observed in countries with a wet climate and a marshy soil, and it has always been considered to be due to some sort of a "miasm" with which the air of such marshes are laden. The term "miasm" was used to represent the cause of malarial fever before it was proved that this human disease was carried by mosquitos, and, accordingly the term "miasm" would now have to be interpreted by the phrase "malaria carrying insect." By analogy with this observation the facts discovered in connection with opthalmia may be interpreted in a similar way; that is to say, some intermediate host will be required to propagate infection. Thus we can understand that it will be possible to establish the disease in South Africa should that intermediate host be present. Climatic conditions exist here very similar to those met with in Europe—where opthalmia is present—and we therefore have reason to believe that the disease may establish itself in South Africa permanently.

Opthalmia is a disease against which a layman cannot sufficiently protect himself, as he may buy an apparently quite healthy horse, and shortly after it may shew symptoms of opthalmia. In this instance the

seller is usually perfectly aware that the horse was infected with this disease, and he sold it at a time when the disease was quiescent, but the cause still present, so that the buyer really obtained a sick horse instead of a healthy one. As far as we are aware there is no legislation to protect a buyer in such cases, unless it is stated at the time of purchase that the horse is perfectly healthy with regard to opthalmia. For this reason in purchasing horses it is advisable to obtain expert evidence in order to be quite certain that the horse had not suffered from opthalmia.

From a prophylactic point of view it is recommended that all horses suffering from acute opthalmia should be isolated in stables, as in many localities it has been noted that the adoption of this precaution has served to check the spread of the disease.

Pustular Stomatitis.

This disease, peculiar to horses, affects them by an inflammation of the mucous membrane of the mouth, causing small pustules to form on the lips and mouth, ultimately developing into small ulcers so that the tongue is occasionally quite raw. At this time the animal refuses to feed, saliva collects and hangs in long strips from its mouth. The disease is undoubtedly contagious, and is probably transmitted from one horse to another by eating out of the same manger, or drinking from the same trough. It is not dangerous, animals do not die from it, although a loss of condition is apparent, but the animal quickly recovers, especially when treated in the proper way. The disease is usually treated in this country by crude methods, which gives animals unnecessary pain, and very often turns a slight affliction into a complicated one.

The application of any substance such as powdered alum, or copper sulphate, is cruelty, whereas if the same substance is dissolved in a weak solution and applied as a wash it acts beneficially.

The best prophylactic measure to be adopted is the separation of affected animals from others until they recover, but since the disease is very mild it is sometimes advisable to allow it to pass through the whole stable, but, at the same time, it should be treated in the way indicated, and soft foods should be administered during this period.

Strangles.

This disease is commonly known in South Africa as "nieuwziekte," *i.e.*, the new disease. This name would suggest that it is a comparatively new disease, but it has been known in Europe for some considerable time. Since the war the disease has been well established, and is now frequently encountered. Strangles plays an important rôle in connection with the scheduled disease of glanders, because it is frequently confused by layman with this latter. Indeed glanders is also commonly called "nieuwziekte;" consequently it is often very difficult to convince the

proprietor of a horse suffering from glanders that it is really infected with that disease and not strangles, as the fact that the animal was suffering for some considerable time is often considered as conclusive proof that it cannot be glanders.

Strangles is now principally a disease of young animals. When it was very prevalent before the war it attacked both young and old horses, because at that time animals had not the immunity against it which they have now. The majority of old horses have, at some time or other, passed through this disease, and consequently they are not now susceptible. Strangles is not dangerous, yet it may lead to many complications, and, undoubtedly, some of these are also due to improper treatment. The cause of the disease is a micro-organism named "streptococcus-equi." This organism seems to be able to live outside the body of the animal for a considerable length of time, so that stables may become infected and act as distributing centres for the disease. Any lowering influence seems to favour the development of strangles, and ordinary colds are very often followed by this disease. On the other hand catarrh of the nose, due to ordinary colds, is easily mistaken for strangles, but since the disease is not of a deadly character, very little importance is attached to it by horse owners. From a practical point of view many consider it advisable to pass young horses through the disease, as they more easily recover than when fully grown. The only precaution necessary in dealing with cases of strangles is to see that affected horses are treated properly, and since the disease principally affects the nose or throat, soft food should be given during illness. A good practice is to let the animal graze in a paddock, where, by taking the food up from the ground, the discharge takes place very easily, and the infective matter is more quickly destroyed by the sun than when the animal is kept in a stable.

It may be well to warn horse-owners here against a common South African custom in the treatment of horses suffering from strangles, that is the practice of saddling up horses showing symptoms of difficulty in breathing on account of an attack of strangles, and riding them as fast as possible in the hope of bursting any abscess which may be forming, and in this way hastening the recovery of the animal. Needless to say that under proper treatment the abscess will burst by itself, without causing any unnecessary damage, whilst riding a horse in a febrile condition cannot fail to be detrimental to the animal.

Contagious Pleuro-pneumonia of Horses.

This disease of horses was very frequent shortly after the war, but it quickly diminished, and is very seldom met with at the present time. There are, however, other kinds of pneumonia which deserve mention, one being frequently found in animals imported from over the sea. On several occasions it has recently come to our notice that horses, mules and donkeys imported from the Argentine suffer from pneumonia. This pneumonia is called "ship's pneumonia," and is characterised as broncho-pneumonia, with extensive destruction of lung tissue (necrosis

and abscess). Some of the animals die from it, others linger on and occasionally die without any definite diagnosis being possible, except the suspicion that the animal coming from board ship may be suffering from some lung lesion.

Precautionary measures against "ship's pneumonia" should be taken on board ship, but it is advisable to warn any farmer before buying newly imported stock to be quite certain that they are not suffering from pneumonia. Should the disease subsequently break out the best treatment is to keep affected animals as much as possible in the open air.

Pneumonia is often caused by the streptcoccus of strangles, and in such cases is a complication of this disease. The precautionary measures and treatment in all cases of pneumonia is that indicated above.

Tetanus.

Tetanus—commonly known as lock jaw—may be found in all animals, but it is principally met with in the horse. It is due to a micro-organism obtaining access to wounds where it develops and produces a strong poison which acts on the nervous system, thereby causing a tetanic spasm, involving the muscles of mastication, hence the popular name of the disease.

At present tetanus is not very prevalent in South Africa, although since the beginning of the century a few isolated cases have been brought to our knowledge. The micro-organism may be found everywhere, and in its life cycle does not depend on any animal. It is frequently found that where organic matter collects and decomposes, say, for instance, around towns and villages, surgical operations are very dangerous, owing to the great prevalence of this bacillus.

From the foregoing it is evident that this disease may be prevented by a careful disinfection of any wounds, particularly in localities where the disease is known to be epidemic. Certain wounds seem to be followed by tetanus more frequently than others—a deep wound, such as is caused by a nail passing through a horse's foot, may introduce the tetanus bacillus, and it is very difficult to kill the organism by disinfection.

The oxygen of the air is not conductive to the development of this bacillus, therefore it does not find so favourable a centre for multiplication in an open wound, but it does in a punctured one to which air cannot gain access.

For some years an anti-toxic serum has been prepared for use as a preventive of this disease, which is frequently employed by veterinary surgeons before undertaking operations in localities where tetanus is prevalent.

(To be continued.)

A DISEASE OF THE PIG, DUE TO A SPIROCHÆTA.

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Several species of the genus spirochæta have been described as being pathogenic for the lower animals, viz.: sp. anserina (Sakarhoff), found in the blood of geese in the Caucasus; sp. theileri (Laveran), found by Theiler in the blood of cattle in the Transvaal; sp. gallinarum, found in the blood of fowls in Brazil; sp. ovina (Blanchard), found by Martoglio and Carpano in the blood of a sheep in Erythrea. The organism was previously discovered in sheep by Theiler in the Transvaal, and he is of opinion that it is identical with that discovered by him in cattle, since in his experiments blood from sheep transmitted the spirochæta to cattle and *vice versa*. The probable reason of the previous failure to transmit the organism was that the animals used had been reared in the district and hence had acquired immunity. Spirochætæ have also been seen in the blood of horses in the Sudan, the Transvaal, and in East Africa.

The spirochæta about to be described was found in the pig, and differs from the foregoing in that the organism found in this animal was seen in cutaneous lesions which were apparently caused by it, that the organism was never observed in the general blood stream of affected pigs, and that the disease has not been communicated to a susceptible animal by means of injections of blood from an affected one. Not too much importance, however, is to be attached to this latter statement, as, although six experiments were made with blood, four of the pigs were inoculated with blood taken from animals which had no external lesions and were not proved to harbour the spirochæta. The fifth pig, No. 48, was injected with blood taken from a diseased animal which had been dead about two or three hours. It will be seen, however, that spirochætæ disappeared even from the lesions soon after death, although they were seen a short time before death took place. The sixth animal, Pig No. 45, was injected with blood from Pig No. 43 immediately the latter had died, and after the lesions had been ascertained to contain the spirochæta. Experiments as to the transmission of the disease by actual contact were made with positive results. Three pigs which had previously been unsuccessfully inoculated with blood from dead pigs were utilised; all three developed lesions, and in two of them spirochætæ were found.

Two cutaneous inoculation experiments were made with scrapings from lesions, one with a positive and the other with a negative result. The latter is attributed to the fact that the scab from an old lesion was used, and it was afterwards ascertained that the spirochætæ disappeared from lesions that were healing up.

History.

Early in February of the present year seven young pigs, only a few months old each but of various breeds, were forwarded to the Government Veterinary Bacteriological Laboratory, Pretoria, for observation. On arrival, one, Pig A, was found to be dead, whilst a second, Pig B, died during the night. Four pigs, Nos. 39, 40, 41, 42, were inoculated subcutaneously with blood from the dead animals on the following morning. One pig, No. 37, was fed with viscera, and two pigs, Nos. 43, 44, were placed in the same pen with the five survivors, whose numbers were C, 119, 116, 120, and 601. About a fortnight later the two "in contact" pigs (which were white in colour) were observed to have several superficial wounds, but not much attention was paid to this fact at the time, as it was thought that the wounds had been inflicted by their fellows in the same pen. Later on these lesions increased in number, until at last the whole of the body was covered with circumscribed superficial ulcers, averaging about three-fourths of an inch in diameter. The edges of the lesions showed no tendency to spread. Many searches were made for the cause of these cutaneous eruptions, attention at first being confined to microscopical examination of the blood of all the animals. Later on the lesions themselves were examined but without success, until on 23rd March spirochætæ were found in a scraping from a fresh lesion on Pig No. 44. Previous to this, Pig C, one of the original seven, had been found to have several old, almost healed lesions behind the ears. This pig was a black one and very hairy, hence the lesions, which showed up very distinctly on the white animals, were only seen on close examination in him. From the time of the first discovery of the spirochætæ onward systematic examination of the lesions was made with varying success. On 28th March the pigs Nos. 43, 44 and C, the latter being the sole survivor of the original seven, were placed in a fresh pen in contact with pigs Nos. 40, 41 and 42. These pigs all contracted the disease, lesions appearing on the 20th, 24th, and 17th April respectively. In pigs Nos. 40 and 42 spirochætæ were found in the lesions, but not in the general blood stream. After a variable period the lesions commenced to heal. The majority of them were very superficial. At first there was a shedding of the epidermis with an extravasation of blood, which on drying up gave rise to a brown scab. Later on this would be shed, leaving a glistening cicatrix. The bristles also dropped off, whether permanently or not I am unable to say. Where the lesions had been very numerous the skin became quite smooth and tense, giving the animal a very peculiar appearance. Spirochætæ could never be found in lesions that were cicatrising. After a time in some cases all the lesions healed up, but, instead of the animals regaining their former health, they continued gradually to lose flesh, until before death they were almost skeletons. Out of a total of thirteen pigs, only two survived, viz., Pigs 41 and C; the former is in good condition, but the latter is still very thin and anæmic.

The *post-mortem* examinations of the deceased pigs were disappointing, as practically the only constant lesion observed was the

anæmic condition of the blood. It will be noticed that several pigs were found to be suffering from pneumonia, but this I consider to be a complication.

In order to be sure that the spirochætæ were confined to the lesions, and not general inhabitants of the skin of pigs and accidentally present in the lesions, scrapings were taken from the skin of healthy, and from the sound skin of affected pigs, and examined microscopically. In no case could spirochætæ be detected. (Plate CLXVII.)

Morphology and Staining Reactions.

The organism belongs to the genus spirochæta (Ehrenberg). It is long and very slender. Its length varies greatly, being from 9 μ to 26μ. Its average length is from 14μ to 16μ. Both extremities are pointed. Spiral forms predominate, but in the same preparation spirochætæ may be seen curved into a semi-circle but without showing any spirals, or simply like long straight threads. The various forms assumed by the organism as seen under the microscope may easily be imagined, as it is motile and very flexible. The spirals themselves vary in number in individual spirochætæ from two to six. The size of the spiral also varies a good deal. Spirochætæ may be found singly or in twos and threes; sometimes one may observe comparatively large clusters of them, containing twenty or more individuals. The organism is not easy to distinguish in unstained specimens, owing to its slenderness and motility. It stains well with any of the aniline dyes in common use, but not by the method of Gram or of Claudius. Romanowsky's method or any of its modifications gives very good results, Giemsa's apparently being the best. By this double staining the organism usually stains uniformly, no nucleus being observed; occasionally, however, some unstained spots or vacuoles could be seen. No attempt was made to obtain cultures on artificial media.

Only one attempt was made to transmit the spirochæta to animals other than the pig. In this case a rabbit was utilised. A subcutaneous pocket was made on the abdomen, and material from a lesion known to contain the organism was inserted. The result was negative, no lesion appearing at the point of inoculation, and the blood remaining normal.

The following is the history of the seven pigs received on 15th February, 1906:—

1. Pig A.—Found dead in railway truck on arrival at Pretoria. *Post-mortem.*—General condition fair. Slight congestion of stomach and intestines, aortic valve thickened. Blood normal.

2. Pig B.—Died soon after arrival at Laboratory, 15th February, 1906. *Post-mortem.*—General condition poor. Intestines congested. Blood normal.

3. Pig C.—Rather poor in condition on arrival. The skin was not specially examined until lesions had been noticed on the experimental animals, when several almost healed scabs were observed

Plate CLXVII. **Photograph of Pig, showing Cutaneous Lesions.**

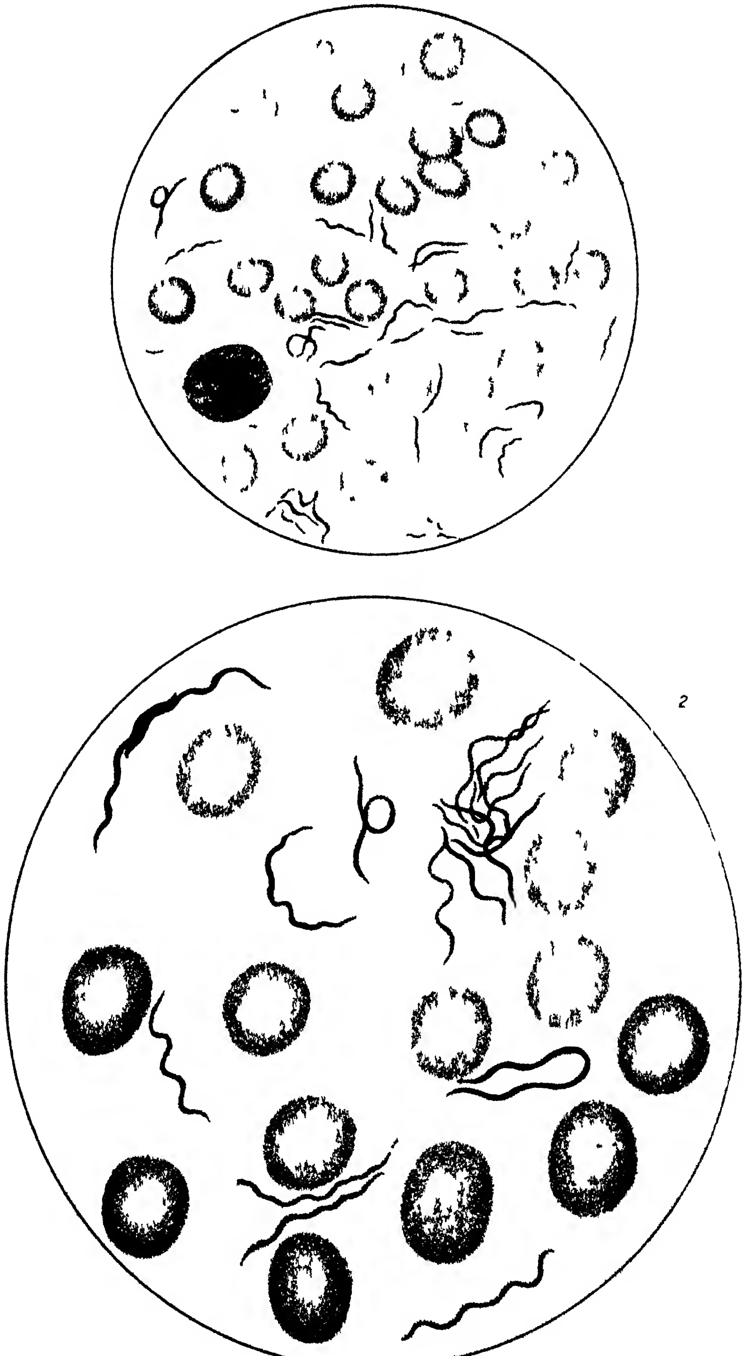

PLATE 167a

on the body. The reason these were overlooked before has already been given. The animal is still alive, but in very poor condition.

4. Pig No. 119.—Died 9th March, 1906. No cutaneous lesions observed during life. Blood always negative. *Post-mortem.*—The stomach showed a few petechiæ. Intestines congested throughout; no necrosis; numerous ascarides in stomach and intestines. All other organs normal in appearance.

5. Pig No. 116.—Died 16th March, 1906. *Post-mortem.*—Body very emaciated. Some discolorations and a few superficial lesions on head. Both anterior lobes of lungs affected with broncho-pneumonia. About two inches of small colon intussuscepted (probably when dying). All other organs normal in appearance. No search was made for spirochætæ either during life or *post-mortem.* An organism morphologically identical with that of swine-plague was isolated from the affected lungs.

6. Pig No. 601.—Died 20th March, 1906. *Post-mortem.*—Body very emaciated. The whole of the skin thickly beset with superficial ulcers, averaging about ⅜ of an inch in diameter. The edges were well defined; some were almost healed and covered with a dry, brownish scab, others were very recently formed. Lungs, both anterior lobes consolidated. Liver, very icteric, numerous caseous nodules in parenchyma. Bile ducts crammed with ascarides. Intestines also contained numerous ascarides. Other organs normal in appearance. Blood very anæmic. No spirochætæ seen.

7. Pig No. 120.—Died 20th March, 1906. *Post-mortem.*—Body very emaciated. No cutaneous lesions. Numerous ascarides in intestines. Other organs normal in appearance. Blood anæmic. No spirochætæ seen.

Although cutaneous lesions were observed in Pigs Nos. 116 and 601 during life, their real significance was not comprehended at the time. The blood was regularly examined with negative results, the only thing noticed being a progressive anæmia. I have no doubt that had the lesions of these two pigs been examined during life in the way that those of the subsequent pigs were, the spirochætæ would have been discovered at some period. With regard to Pig C, the animal had almost recovered before the lesions were observed, and hence the spirochætæ had disappeared.

Experiments with Pigs.

1. Pig No. 43.—Placed in contact with the five surviving pigs on 16th February, 1906. Died 7th April, 1906. Cutaneous lesions first observed on 2nd March, 1906. Microscopical examination of the blood was made from the beginning, and that of the lesions was commenced on 16th March. The blood always proved negative, but the spirochæta was first discovered in the lesions on 20th March. They appeared usually in small numbers, and only one or two clusters were observed during the subsequent examinations. Temperature remained normal. Appetite was very capricious. The animal lost flesh gradually.

Post-mortem.—Carcase very emaciated. Numerous superficial circumscribed ulcers covering the body, averaging about ¾ of an inch in diameter. Very recent lesions in ears and on head. Spirochætæ had been found in the recent lesions the previous day, but they had disappeared *post-mortem.* The blood was anæmic, poikilocytosis being very marked. No spirochætæ. Anterior lobes of lungs hepatised. All other organs normal in appearance.

2. Pig No. 44.—Placed in contact with the above five pigs on 16th February, 1906. Died 13th May, 1906. Temperature remained normal. Appetite fair, but animal gradually wasted away. Cutaneous lesions first observed about 1st March. Microscopical examination of them commenced on 16th March, but proved negative until 23rd March, when a recent lesion was found to contain numerous spirochætæ. The entire body by this time had become covered with typical lesions. Subsequent examinations were made with great regularity, but no more spirochætæ could be found until 27th March, when again they were seen in the recent lesions. The blood, although examined daily and at various hours of the day, always proved negative. The disappearance and reappearance of the organisms went on with very irregular intervals. The lesions gradually decreased in number until at the time of death only two were seen. *Post-mortem.*—Carcase very emaciated; only two ulcers on body, and these almost healed up. Skin tense, smooth, and glistening, and almost devoid of bristles. Duodenum slightly congested. All other organs normal in appearance. No spirochætæ in lesions or blood; the latter very anæmic.

3. Pig No. 39.—Injected 16th February, 1906, subcutaneously with 5 cc. of heart blood from Pig A. No temperature reaction, and blood remained normal. On the 18th March, 1906, the pig was inoculated cutaneously by scarification of two places, each about one inch in diameter, one on the flank and one behind the ear, with material taken from a fresh lesion on Pig No. 44. The lesion was previously ascertained to contain spirochætæ. The scarified areas remained unhealed for some time. On 8th April, 1906, a lesion was noticed upon the forehead, and a second on the fore leg on 25th April. From that time onward numerous lesions appeared on various parts of the body. Spirochætæ were found in the fresh lesions in very sparing numbers and at irregular intervals. The blood examination always remained negative. Temperature remained normal and the appetite was good. The pig, however, gradually lost flesh, and died on 18th May, 1906. *Post-mortem.*—Carcase very emaciated. No cutaneous lesions to be seen, all having healed up. Small colon showed intense patchy congestion. Blood anæmic; no spirochætæ.

4. Pig No. 38.—Inoculated 24th March, 1906, by scarification of skin in the same manner as Pig No. 39, with the scab from an almost healed lesion from Pig No. 44. No reaction took place. The wounds healed up in the normal manner. No other lesions occurred, and the blood remained normal. No spirochætæ had been seen in the inoculating material.

5. Pig No. 41.—Injected subcutaneously on 16th February, 1906, with 5 cc. blood from Pig B. No temperature reaction, and blood remained normal. On 28th March, 1906, the pig was placed in contact with Pigs C and Nos. 43 and 44. Only two cutaneous lesions appeared. No spirochætæ were seen at any period, either in the lesions or in the blood. The animal remains alive, is in good condition, and apparently quite healthy.

6. Pig No. 40.—Injected subcutaneously on 16th February, 1906, with 5 cc. of blood from Pig B. No rise of temperature took place, and the blood remained normal. On 18th March he was placed in contact with Pigs C and Nos. 43 and 44. Cutaneous lesions appeared on 20th April, and increased in number until they were fairly numerous. This pig was a very hairy animal, but as the lesions healed up the bristles disappeared, until the skin became quite smooth. Spirochætæ were found in the lesions at very irregular intervals, and, as a rule, sparingly, but on one or two occasions they were quite numerous. The animal gradually lost flesh, and became so weak that he was finally killed on 18th May, 1906. *Post-mortem.*—Carcase very emaciated. A few typical lesions on body, and also some general abrading of the skin along the spine. All organs normal in appearance. No spirochætæ seen in lesions or blood; the latter anæmic.

7. Pig No. 42.—Injected 15th February, 1906, subcutaneously with 5 cc. blood from Pig A. No temperature reaction took place, and the blood examination remained negative. On 28th March the animal was placed in contact with Pigs C and Nos. 43 and 44. The first cutaneous lesion appeared on 17th April, and on 25th April two more were seen. A few spirochætæ could be detected in the lesions on microscopical examination, but the blood examination always remained negative. Death took place on 28th April. *Post-mortem.*—Carcase very emaciated. Superficial cutaneous ulcers along back and on quarters and legs. Lesions were quite typical in appearance and about ¾ inch in diameter. Some were quite healed up. Lungs showed some areas of collapse. All other organs normal in appearance. No spirochætæ to be seen in lesions or blood; the latter anæmic.

8. Pig No. 45.—Inoculated subcutaneously 7th April with 10 cc. heart blood from Pig No. 43. No temperature reaction occurred, and the blood remained normal. Animal continues in good condition.

9. Pig No. 48.—Inoculated subcutaneously with 6 cc. blood from Pig No. 601 on 10th March, 1906. No reaction took place. The temperature and blood remained normal, and the animal remains well.

Description of Plate 167a.

Fig. 1. Spirochætæ from local lesion in a pig. Drawing made from a single field of the microscope (Zeiss apoch. ob. 3 mm.; oc No. 6; tube 160 mm.). The organisms have been drawn a little too thick in this figure.

Fig. 2. Ditto, but representing a composite field (Zeiss oc, No. 6; ob. 1-12 in; tube 160 mm.).

THE CHEMICAL SECTION.

I.] SOIL EXHAUSTION.

By Herbert Ingle, B.Sc., F.I.C.

Enquiries have recently been made by various correspondents as to the reputed exhausting effect upon soils of the growth of certain crops. A brief discussion of the subject may, therefore, be of interest to our readers.

To undertake any subject, it is always the best to commence with fundamentals. The tissues of plants consist of various chemical compounds, some of extreme complexity, but the *elements* out of which these compounds are formed are comparatively few.

Most living vegetable matter consists largely of water, thus, despite their solidity, root-crops, *e.g.*, turnips, potatoes, etc., contain more than three-fourths their weight of water. The other constituent elements may conveniently be divided into two great groups:—

A. Combustible or organic—which are evolved in gaseous form when the plant is burned.

B. Non-combustible or mineral—which are left behind in the ashes.

Included under A, the chief elements are carbon, oxygen, hydrogen, nitrogen, and, to a limited extent, sulphur and phosphorus, though the greater portions of the last two are usually left in the ash.

Under B are found silicon, calcium, magnesium, potassium, sodium, iron, phosphorus, sulphur, chlorine, and oxygen.

To form vegetable matter, then, it is essential that the plant be supplied with the following elements:—

Carbon.
Oxygen.
Hydrogen.
Nitrogen.
Sulphur.
Phosphorus.
Chlorine.
Silicon.
Calcium.
Magnesium.
Potassium.
Sodium.
Iron.

Next, as to the means by which the plant obtains these materials. The absorbing organs are the *roots* and the *leaves*. The former, in

contact with the soil, are able to take in water and the substances dissolved in the water. These include compounds of nitrogen (probably entirely as nitrates), calcium, potassium, phosphorus, sulphur and the other ash-constituents.

Thus it is from the *soil* that the plant obtains by means of its roots all the—

Water,
Nitrogen,
Ash-constituents,

required for its growth.

But the largest constituent of the dry matter of plants—carbon—is obtained by the *leaves* of the plant from the *atmosphere.*

Now, the products from plants are valuable to man for many purposes. From the point of view now under consideration, however, we may classify these products into two great groups of substances:—

1. Nitrogenous and carbonaceous materials, containing also ash-constituents, such as are often suitable to form the food of animals. Examples of this class are ordinary seed-crops—wheat, mealies, etc., and forage crops—clover, lucerne, etc.
2. Carbonaceous materials only, practically free from nitrogenous compounds and ash. Such bodies are not adapted to furnish animals with a complete food, and are used either as part of the diet, or for industrial purposes. Examples of this class are oils, starch, linen, cotton, etc.

All plants require the constituents named in the list already given, but it sometimes happens that the portion of the plant which is valued, and for which the crop is grown, consists entirely of carbon, oxygen and hydrogen—the rest of the plant being comparatively valueless for industrial purposes. If such plant residues be returned to the soil, the latter is not robbed of any of its plant food, and the valued portion of the crop is obtained *entirely from the atmosphere* and not from the soil.

In the case of most crops used for food, the value of the produce depends very largely upon the proportion of nitrogenous compounds—protein—and of ash-constituents, particularly lime and phosphates, which it contains, and these are just the constituents which the plant abstracts from the soil, and upon which soil fertility mainly depends. It is, therefore obvious, in the case of many general crops such as are used for food purposes that they cannot be produced from land except at the expense of its fertility unless the losses which it suffers are made good by the addition of suitable manures.

Some virgin soils are very rich in plant food and will yield crop after crop for years without manure. But a limit is always reached, after which the productiveness of the soil diminishes unless the drain upon its resources is compensated by the application of manures.

The time it takes to reach this limit depends upon many circumstances—

1. The initial richness and depth of the soil.
2. The number and kinds of crops raised.
3. The method of farming and particularly the disposal of the produce.

The importance of the first of these is obvious and requires no comment. The second, too, is clearly important, since, as will be shown later, the demands upon the soil of different crops vary greatly.

The third condition is worth a little consideration, since, by modifications here, the success or otherwise of the farming may be greatly influenced.

Suppose, for example, a farmer grows large quantities of oat-forage, which he sells. The whole crop, with the exception of the roots and stubble, is removed from the farm and none of it is returned to the land. In each ton of dried forage there would be removed about—

Nitrogen	18 lbs.
Lime	4 "
Phosphoric acid	7 "

These estimates are based upon analysis of Transvaal-grown forage.

In Britain, when oats (which are richer in manurial ingredients there than here) are grown, the usual plan is to use the straw entirely on the farm as food or litter, and, at most, to sell a portion of the grain. Assuming that all the grain be sold but the straw returned to the soil in the form of farmyard manure, the loss per ton of oats at harvest would be about

Nitrogen	15 lbs.
Lime	0.9 "
Phosphoric acid	6.0 "

while, in the straw, there would be restored to the soil about

Nitrogen	9 lbs.
Lime	4.9 "
Phosphoric acid	3.2 "

In this case it will be seen that, of the total nitrogen contained in the crop, about ⅜ths are restored to the soil, of the lime about ⅚ths, and of the phosphoric acid about ⅓.

With other crops, of course, the results would be different. But it is clear from the above considerations that, when a farmer sells ordinary foodstuffs to be consumed off his farm, the latter is being robbed of the plant food upon which its fertility depends, and if the productiveness of the land is to be maintained, it is essential that some additions of manurial material should be made. The losses are greater if the crops grown are rich in nitrogenous compounds and ash-constituents.

On the other hand, certain products, some of them of considerable value, may be produced which take little or nothing from the soil, being built up by the plant almost entirely from raw materials

obtained from the air by the agency of sunlight. Such products are—

Carbohydrates, *e.g.*, starch and sugar.

Oils and fats.

These substances contain no nitrogen or ash-constituents, and, though the vegetable matter which yields them contains those substances, there is, in many cases, no reason why these valuable manurial substances should be removed from the farm. Under such conditions, the soil is not robbed of its fertility, and, indeed, should become more and more productive with cultivation. Such crops are few, and it is only in somewhat rare cases that it is possible to cultivate land under such favourable conditions.

As an example of a crop which it is possible to cultivate in this manner, I may cite castor oil, enquiries about which have been received from several interested farmers.

There appears to be a view current that the growth of the castor oil plant is particularly exhausting to the soil.

The substances taken up by the plant are partly locked up in the trunk, roots, stems, leaves, etc., of the plant, but are largely concentrated in the seeds and pods. In any case, only the two latter are sold off the land. Assuming that 1,000 lbs. of seeds and 800 lbs. of husks or pods are removed from each acre per annum, the beans would contain about

35 lbs. of combined nitrogen,
4 „ potash,
14 „ phosphoric acid,

while the pods or husks would probably contain

13 lbs. of combined nitrogen,
46 „ potash,
2 „ phosphoric acid.

Thus, if the pods and their contents be removed from the farm, the soil would be robbed of about

48 lbs. of combined nitrogen,
50 „ potash,
16 „ phosphoric acid,

per acre per annum, which is about the loss suffered by land bearing a good crop of wheat—according to Warington this amounts (30 bushels of grain and 3,000 lbs. of straw per acre) to

	In grain.	In straw.	Total.
	lbs.	lbs.	lbs.
Nitrogen	34	16	50
Potash	9.3	19.5	28.8
Phosphoric acid ..	14.2	6.9	21.1

Thus castor oil (seeds and husks) remove about the same quantity of nitrogen, distinctly more potash, but less phosphoric acid from land as are removed by a good crop of wheat.

But the really saleable portion of the crop from castor oil plants is the oil, which, like other true oils, contains only carbon, hydrogen and oxygen, and is free from nitrogen and mineral matter.

Consequently the grower of castor oil should restore to the soil the pods or husks and the "cake" left after the extraction of the oil. Under these conditions he would remove from the farm nothing but what was produced from the air and water, and his soil would be unchanged in the amount of plant food which it contained, except for the small quantities of material locked up in the woody matter of the trees.

He could either remove the husks from the seeds before taking them to the oil mill, or receive in exchange an equivalent quantity of husks removed there, and he should bargain with the seed crusher to receive, say, 500 lbs. of "castor cake" for each 1,000 lbs. of seed he delivers, and restore these to the soil.

Under these conditions, his soil should not be impoverished by the production of castor beans, but should, on the contrary, become more and more fertile since the plant food contained in it should be gradually rendered more available to plants. Similar considerations apply to the production of animal matter.

In a dairy farm where butter is the chief product sold, the depletion of the land of its valuable ingredients is very small, whereas the sale of milk or cheese takes away considerable quantities of nitrogen, lime and phosphates, and unless some compensation in the way of manures or artificial feeding stuffs be made to the farm, its fertility is gradually diminished.

In the same way, the sale of animal carcasses—beef, mutton, pork, etc., removes from the farm, in a concentrated form, considerable quantities of the substances necessary for fertility, especially nitrogen, lime and phosphates. The production and sale of wool, feathers, etc., are also a drain upon the soil's stores of nitrogen, potash, etc.

It would be well for the farmer to always keep in mind that the production of carbohydrates, *e.g.*, sugar and starch, or of oils, can be achieved without much exhaustion of the soil's fertility, the only demands being for the materials necessary to build up the organs of the plant by which the valued product is elaborated from the carbon dioxide in the air, and these materials may, with suitable management, be almost wholly returned to the land. In these instances, the farmer sells what he has produced out of materials obtained from the atmosphere. With plants which are valued for feeding purposes, however, and which, therefore, are rich in protein (nitrogenous substances) and mineral matters, depletion of the soil's stores of plant food is inevitable and must bring about exhaustion of fertility unless compensating additions in the form of manure are made. In such cases the farmer is actually paid for the constituents derived from the soil.

The importance of restoring to the soil any waste vegetable or animal matters which may occur on the farm is obvious, since such methods would tend to postpone the ultimate exhaustion of the land which must ensue if some return is not given in exchange for the crops removed.

The most expensive item of plant food, when purchased as manure, viz., combined nitrogen, can, fortunately, be obtained from the air by means of the micro-organisms which inhabit the root nodules of leguminous plants. However, reports of some length on this subject have already appeared in this "Journal," and the reader who desires further information respecting it is referred to Vol. III., pp. 265, 525, 725.

In conclusion, it may be of interest to give estimates of the amounts of the chief items of plant-food removed from an acre of land by average yields of various crops. The figures in the following table are abridged from Warington, and give the weights in pounds per acre:—

	Wt. of Crop	Nitrogen	Potash.	Lime.	Phosphoric Acid.
Wheat, grain, 30 bushels	1,800	34	9.3	1.0	14.2
„ straw	3,158	16	19.5	8.2	6.9
Total	4,958	50	28.8	9.2	21.1
Barley, grain, 40 bushels	2,080	35	9.8	1.2	16.0
„ straw	2,447	14	25.9	8.0	4.7
Total	4,527	49	35.7	9.2	20.7
Oats, grain, 45 bushels ..	1,890	34	9.1	1.8	13.0
„ straw	2,835	18	37.0	9.8	6.4
Total	4,725	52	46.1	11.6	19.4
Maize, grain, 30 bushels	1,680	28	6.5	0.5	10.0
„ stalks, etc. ..	2,208	15	29.8	?	8.0
Total	3,888	43	36.3		18.0
Meadow Hay, 1½ tons ..	3,360	49	50.9	32.1	12.3
Clover Hay, 2 tons ..	4,480	98	83.4	90.1	24.9
Beans, seed, 30 bushels..	1,920	78	24.3	2.9	22.8
„ straw	2,240	29	42.8	26.3	6.3
Total	4,160	107	67.1	29.2	29.1
Turnips, roots, 17 tons..	38,080	61	108.6	25.5	22.4
„ leaves	11,424	49	40.2	48.5	10.7
Total	49,504	110	148.8	74.0	33.1
Mangels, roots, 22 tons..	49,280	98	222.8	15.9	36.4
„ leaves ..	18.233	51	77.9	27.0	16.5
Total	67,513	149	300.7	42.9	52.9
Potatoes, tubers, 6 tons..	13,440	46	76.5	3.4	21.5
Beech, wood (dry) ..	2,822	10	4.2	12.9	1.5
„ leaves (dry) ..	2,975	39	8.8	73.1	9.3
Total annual produce..	5,797	49	13.0	86.0	10.8

The very great exhausting effect of mangels and turnips upon a soil are particularly noticeable, especially the great demands they make for nitrogen and potash. Clover, beans and other leguminous crops contain very large quantities of nitrogen, but, owing to the powers possessed by micro-organisms in the nodules which are so frequently found on their roots of obtaining nitrogen from the air, they do not necessarily deplete the soil. On the other hand, it will be noticed that they make considerable demands upon the potash, lime and phosphoric acid of the soil.

In the case of fruit trees, as already stated, the plant food of the soil is used in two ways:

1. To form the fruit, which, under ordinary conditions, is removed from the tree and lost to the land.
2. To be locked up in the trunk and branches of the trees or in their leaves. In the case of deciduous trees the leaves annually restore a portion of the plant food to the soil.

Various fruits make very different drains upon the soil's resources. The losses per acre of land bearing fruit will obviously vary greatly with the size of the trees and of the crops which they bear.

In the following table are given the chief manurial ingredients removed from the soil by 1,000 lbs. of each of the fresh fruits named:

Fruit	Nitrogen	Potash	Lime	Phosphoric Acid.
Almonds	7.01	9.95	1.04	2.04
Apricots	1.94	3.01	.16	.66
Apples	1.05	1.40	.11	.33
Bananas	.97	6.80	.10	.17
Cherries	2.29	2.77	.20	.72
Chestnuts (with husks)..	6.40	3.67	1.20	1.58
Figs	2.38	4.69	.85	.86
Grapes	1.26	2.55	.25	.11
Lemons	1.51	2.54	1.55	.58
Olives	5.60	9.11	2.43	1.25
Oranges	1.83	2.11	.97	.53
Peaches	1.20	3.94	.14	.85
Pears	.90	1.34	.19	.34
French Prunes	1.82	3.10	.22	.68
Plums	1.81	3.41	.25	.75
Walnuts (with shells) ..	5.41	8.18	1.55	1.47

The figures are obtained from American sources.

In the case of apples we find that South African grown samples agree fairly well in composition with the figures in the table, though the amount of lime present is slightly lower. Probably the amount of nitrogen in apples is usually less than that given in the table.

II.] NOTE ON THE PEA NUT (*Arachis hypogœa*).

By Herbert Ingle, B.Sc.

The plant is largely grown in various parts of the world: in India, the warmer parts of the United States of America, in the South of Europe, and in Western Africa.

The plant is a leguminous one and its roots are frequently found to possess numerous large nodules inhabited by a variety of *bacillus radicocola*, thus enabling the parent plant to obtain supplies of nitrogen from the air.

It has a peculiar method of ripening its seeds. After flowering, the stem lengthens and curves downwards, thus burying the fruit in the ground. A loose, pliable, sandy soil is thus most fitted for this crop.

Like other *leguminosæ* it requires abundant supplies of potash, phosphoric acid and lime in the soil, but can usually thrive on soils comparatively poor in nitrogen, since it can utilise the free nitrogen of the air.

Some notes on the planting and culture of pea nuts appeared in the Botanical Section of the last issue of the "Journal" (No. 17, Vol. V., p. 161), so that further reference to this matter is not required here.

The seed is contained in paper-like husks or pods which may contain one, two, three or four seeds each, depending upon the variety.

The seeds are rich in oil, protein and ash, and are valued as a food, having, especially after roasting, an agreeable nutty flavour, and particularly as a source of oil.

The oil obtained from pea nuts is generally known as Arachis oil. It possesses a pleasant flavour said to recall that of kidney beans, and the better qualities are used as salad oil. Inferior samples are used for burning and for the manufacture of soap. In the extraction of oil from the seed, the husks or pods are first removed, then the thin skin which envelopes the kernel and which may be either white, yellow or red in colour. This latter process is generally accomplished by a blast of air.

The kernels are then ground and subjected to hydraulic pressure at the ordinary temperature. The oil which is thereby expressed is known as "cold-drawn" oil and is nearly colourless. The "cake" is then re-ground, heated, and again pressed, whereby a more highly-coloured oil is obtained.

The cake left after the final pressing is a very valuable and concentrated cattle food.

According to American analysis it contains:—

Moisture	10.7
Ash	4.9
Protein	47.6
Crude fibre	5.1
Carbohydrates	23.7
Oil	8.0
	100.0

Thus having an "albuminoid ratio"* of about 1 : 0.9, pea nut cake is thus an excellent substance for mixing with starchy foods: mealies, rice, etc., in order to frame a ration sufficiently rich in nitrogenous matter.

The following analyses represent the average composition of the various parts of the plant according to American results:—

	Kernels.	Husks.	Vines after blooming.
Moisture	10.0	10.0	10.0
Ash	2.2	3.0	12.4
Protein	26.6	6.0	10.0
Fibre	2.4	65.2	22.0
Carbohydrates ..	16.8	14.1	42.0
Oil	42.0	1.7	3.6
	100.0	100.0	100.0

It thus appears that the kernel of the American-grown crop contains, on the average, 42% of oil. According to Lewkowitsch (Chemical Technology of Oils, Fats and Waxes, Vol. II., p. 598), the kernels contain from 43 to 45% of oil.

During the past few months, several specimens of pea nuts have been examined in the Laboratories, and it may be of interest to some of our readers to see the results. Three of the samples were grown in the Transvaal from seeds obtained elsewhere. The fourth variety was imported.

No. 1 was grown at Warmbaths from Natal seed.
No. 2 was grown locally from Virginian seed.
No. 3 was grown locally from Spanish seed.
No. 4 was imported "Mammoth."

The thin skin on the kernels of Nos. 1, 2 and 3 was pale pink in colour, that on No. 4 deep red. The pods of No. 4 were by far the largest, and a large portion of them contained four or three kernels each; those of No. 3 were the smallest and a large proportion contained only one seed.

The weight in grammes of 100 pods of each variety was:—

No. 1	110.0		
No. 2	155.4	and contained	169 kernels.
No. 3	102.4	„ „	170 „
No. 4	190.3	„ „	288 „

This corresponds to the following average numbers of pods in 1 lb. avoirdupois:—

No. 1	408
No. 2	292
No. 3	443
No. 4	238

* For explanation of this term see this Journal, No 16, Vol. IV., page 816.

The proportion of "husk" or "pod" to kernel was highest in No. 2 and lowest in No. 1, the percentages being:—

	Husk.	Kernel.
No. 1	22.79	77.21
No. 2	33.90	66.10
No. 3	23.59	76.41
No. 4	28.34	71.66

The kernels were analysed and gave the following results:—

	No. 1.	No. 2.	No. 3.	No. 4.
Moisture	3.50	4.88	5.05	4.37
Protein	—	30.13	31.19	24.82
Oil	51.40	46.06	46.08	54.35

Thus, for oil-content, No. 4 is the most valuable; Nos. 2 and 3 the least.

If the kernels are sold (removed from the husks) No. 4 would thus be the best, followed by No. 1, while Nos. 2 and 3 are approximately equal and distinctly less in oil-content.

All the samples, however, are richer in oil than the average American and European products. This is partly accounted for by the greater dryness of our samples (the percentage of moisture being only about 4.5% as against 10%), but even allowing for this, it would appear that the samples 1 and 4 were richer in oil than the average. But pea nuts are usually sold in their pods, and a better method of gauging their value would be to quote the amount of oil contained in the kernels obtainable from 100 lbs. of the whole nuts.

These are as follows:—

No. 1	39.69
No. 2	30.45
No. 3	35.21
No. 4	38.95

Thus a given weight of the whole nuts (husks and kernels) of sample No. 1 contains the largest proportion of oil, followed closely by No. 4, then by No. 3, and, lastly, by No. 2.

The cake remaining after the extraction of oil from the above sample would obviously be very rich in protein, and would form an excellent addition to the diet of cattle, and would greatly enhance the manurial value of their excrement.

The crop obtainable varies with conditions; in America it is estimated at about 40 to 60 bushels of about 22 lbs., though up to 100 bushels per acre are sometimes obtained.

Taking 50 bushels per acre, this would correspond to about 1,100 lbs. of "nuts," which, if equal to No. 1 in oil-content, would contain about 400 lbs. of oil.

A point of great importance, however, is the relative cropping powers of the varieties.

This crop is worth the attention of farmers, as there appears to be the possibility of a considerable trade in the nuts.

III.]

NOTES FROM THE CHEMICAL LABORATORIES.

Arsenical Poisoning.

Numerous cases of poisoning of stock by arsenic have been investigated in the Laboratories, and I would here draw special attention to the necessity of care in the use of such excessively poisonous substances as white arsenic and especially arsenite of soda.

These substances serve valuable purposes, and have proved a great boon to this country, but it should be remembered that those using them are "playing with edged tools." Carelessness in leaving arsenical preparations, whether used in dips, locust destruction, scrub extermination, or in any other way, on the veld or in places accessible to stock may, and apparently often does, lead to considerable losses. Cases of quantities of arsenite of soda in the solid form or of the residues from arsenical dips being found lying on the veld have been brought to my notice, and, naturally enough, where cattle, sheep or goats are abundant, such carelessness leads to disaster. Moreover, the confusion of arsenical dips with other sheep dips and their administration as medicines to stock is another example of carelessness for which the persons interested may have to pay heavily.

The administration of white arsenic in the solid form to animals usually leads to death from poisoning, although this substance (arsenious oxide) is only sparingly soluble in water. But, with arsenite of soda, the danger is much greater because of its ready solubility in water, ensuring its rapid absorption from the stomach and intestines.

When solid white arsenic is given to an animal, a considerable portion may pass through the body undissolved, and death may not result from a certain dose. In a second case, if a much larger quantity be given, death may be produced at once, though the total quantity of arsenic absorbed in the second case may not exceed that given in the first. With large doses, the amount of surface of arsenious oxide exposed to the action of the alimentary juices is much larger than with small doses, and this may determine the fatal effect.

It is also a fact that equal quantities of arsenious oxide given in one case in the solid state, and in another in solution, may have very different effects. In the former case the animal may recover, while, in the latter, it would probably be killed at once. Now, arsenite of soda dissolves with the greatest ease in water or the digestive juices, consequently, when administered to animals, it acts with great energy as a poison.

The above considerations explain why there is so much discrepancy among different authorities as to the lethal dose of arsenic for various animals. In spraying grass, etc., with arsenite of soda solution for the destruction of locusts, it must be remembered that it is not the actual strength of the solution merely that is important, but also the

rate at which the spraying is done. The *solution* is not consumed by the insects (or by stock afterwards), but the vegetation on which the solution has dried, and the same *weight of arsenite of soda* per lb. of grass might be produced by spraying lightly with a strong solution or heavily with a dilute solution.

If the spraying could be always done at exactly the same rate, *i.e.*, one gallon made to cover exactly the same area, then the amount of arsenic per unit area would be proportional to the strength of the solution, but I imagine that this is rarely the case.

With such a substance as arsenic, it is always wisest to err on the safe side, and cattle, poultry, etc., should be kept off the ground which has been sprayed until several heavy showers of rain have washed the arsenic into the ground.

Moreover, the use of locusts poisoned by arsenic as food for poultry, though in many cases it may be harmless, should be made with caution, for poisonous effects are quite possible, and it is foolish to run unnecessary risks.

However, the main object of the present note is to call attention to the stupid carelessness of leaving actual solid arsenite of soda on the ground accessible to stock and to emphasise the need of common sense in handling such a powerful agent as arsenic. With proper care it may do an immense service, but, like all desperate remedies, it requires to be treated with proper respect and with a full recognition of its dangers. There is, of course, always the probability of "familiarity leading to contempt," but arsenic should be used with all the care and caution that one would employ with gunpowder, dynamite or other explosive. It is true that its effects are not so sudden and impressive as those of explosives, but they may be quite as disastrous.

Oil-Bearing Seeds.

Some doubt having arisen as to whether the kernels whose analysis was given on page 136 of the last issue of the "Journal," were really obtained from the "Meroola" or "Marula," as described; a few specimens of the whole fruit of this tree were obtained by the courtesy of the Agrostologist and Botanist, and a partial examination was made of the new material. The original whole fruit weighed 144.64 grammes. Of this, 23.29 grammes, or 15.95%, consisted of the "stones." The stones were broken and the kernels removed as completely as possible. These weighed 2.42 grammes or 1.67% of the whole fruit, or 10.35% of the "stones."

The kernels were then extracted with ether and yielded 55.84% of their weight of oil, an amount greater than that found in the kernels sent by Mr. Bailey (48.72%). The kernels in the new specimen were distinctly smaller in size than those of the Thabena sample. Unfortunately, the amount of material at disposal was not sufficient to permit of a fuller examination. Whether the substance

on which the previous report was given was really Merula or not, therefore, remains doubtful, but the true Merula seems undoubtedly to contain a kernel very rich in oil, though the proportion of kernel to stone is disappointingly small.

Maraamas.

A sample of a bean bearing this native name, but which has not yet been identified botanically, was received from Mr. Burtt-Davy. It had been grown in the Waterberg District. The beans were large and flat, of a deep brown colour; 100 of them weighed 240.87 grammes. The outer cover was hard and brittle, more in the nature of a shell than a skin. The beans yielded:—

53.39% of white kernel.
46.61% of hard husk or shell.

The kernels contained:—

Oil	35.78	per cent.
Protein	31.28	"
Moisture	3.76	"

As soon as the weather becomes cooler so as to allow of the use of ether, we hope to extract a quantity of the oil sufficient for a determination of its properties and possible uses. The kernels have a bitter tannin-like taste.

THE BOTANICAL SECTION.

No. 1.]

NATIVE TREES OF THE TRANSVAAL.

By Joseph Burtt-Davy, F.L.S., etc.

At the last annual meeting of the Transvaal Agricultural Union, a delegate from the Lydenburg District complained that reserved timber in Government Forests was sometimes cut by mistake for less valuable species, owing to the close outward resemblance between certain trees having very different timber values. No specific case was cited, so that we are unable either to confirm or to deny the statement; but in travelling about the country the writer has noted that much uncertainty exists in the minds of woodcutters and others well accustomed to the forests, as to the identity of certain trees. In a new country, where no scientific investigation of the native trees has ever been carried out, this is scarcely to be wondered at, especially in view of the fact that there are some 270 distinct species of trees in the Transvaal (not including named varieties) several of which are new to Science. But it is of great importance that this state of affairs be remedied as soon as possible, in order that the regulations adopted for the conservation of the native forests may be carried out intelligently and effectively.

It is desirable that an illustrated and descriptive account of the trees should be published for the guidance of those owning or otherwise interested in the "bush," and especially of those engaged either in cutting timber or conserving the forests; this handbook should contain *keys* to enable foresters and woodmen to discriminate easily between closely related species. The writer has been for some time engaged on such a book; the first step towards its accomplishment is the publication of a *Preliminary Classified Catalogue* of the species, with an indication of their distribution, which will serve both as a check-list and as a means of collecting more data, and will also give to those of our correspondents who are willing to collaborate with us, opportunity to furnish such information as at present we lack.

The *Preliminary List* must necessarily be incomplete, but it is published in order that information already acquired may be made available to others, and that further data may be secured which may make the later publication more accurate and complete by the added observations of colleagues and correspondents.

It doubtless errs somewhat by the inclusion of a few species which perhaps do not attain the size of trees; this is particularly the case with the species of Rhus and of Acacia, two large genera about which very little is at present known.

Some species are so local in their distribution that we have not yet had opportunity to see them in their native haunts, and the books are too often silent as to their size of growth.

Many species which occur on the kopjies of the High veld or the western Middle veld, only as shrubs, are known to become good-sized trees in more favoured localities ; we are constantly adding to the list of trees by information on this point from the remoter parts of the Colony.

Again, there are several species not yet identified owing to lack of complete material, and which are not included in the list.

I have, therefore, preferred to err on the side of inclusion rather than exclusion, and the total number of actual trees is not likely to vary greatly from that here given.

Life Zones.

The native trees of the Transvaal occur in well-marked phytogeographic zones of vegetation, doubtless due to the peculiar climatic conditions, as outlined in my paper in the October, 1905, issue of the "Journal" (Vol. iv., No. 13, pp. 114-134). I need not here recapitulate the topographic and climatic conditions of each, but for clearness will mention the principal zones as they affect the native trees. These are:

1. The Mist-belt Forest, occupying the upper eastern slopes and kloofs of the Drakensberg Mountains, and having the heaviest rainfall and most humid atmosphere of any part of the Transvaal. This is the only true *Forest Region* in the Transvaal, and contains at least 64 distinct species of trees. These are largely species which occur also in the Eastern Province forests of Cape Colony, and scarcely any of them are met with in any other part of the Transvaal. A characteristic feature is the evergreen character of the trees, the common occurrence of epiphytes, lianes and ferns, and the relative scarcity of species of Acacia and other Leguminosæ and of Combretum and Rhus, as compared with their prevalence in the middle veld.

2. The High veld zone, exclusive of the Mist-belt forest, and descending to about 4,000 feet altitude. This is a typical *Grass-steppe Region,* and trees are rare. In certain places, however, small groves of Zoet-doorn (*Acacia horrida?*) are met with, while the rocky kopjies and randjies produce a sparse growth of shrubs and small trees, such as Cussonia, Protea, Chrysophyllum, Vangueria, Gymnosporia, Acacia, etc. On the limestone outcrops of the extreme west the Karee-boom (*Rhus viminalis*), Kressen-reef (*Euclea undulata*), Witgat boom or Wit stink-hout (*Celtis rhamnifolia*), Blink-blaad-wacht-'n-bietje (*Zizyphus mucronata*) and the Olievenhout (*Olea verrucosa*), are by no means uncommon, though few and far between. Along the Vaal River the Wilge-boom (*Salix capensis*) is of frequent occurrence. In all 42 tree species are recorded, but the High veld is by no means a tree zone, and for miles one may travel without seeing either tree or bush of any sort.

3. The Middle veld zone, also known as the Bush veld. The term Bush veld is exceedingly appropriate, but as it is also applied in popular parlance to the Mist-belt forest and to the true Low veld, it cannot be used to clearly define the region in question, and it is preferable to speak of it as Middle veld. Though for the most part covered with trees, of which 122 species are recorded, this is not a forest, but a *Savannah Region*, the trees occurring sparsely and not forming forest masses. The trees are largely deciduous, at least for a short season. Species of Acacia and other Leguminosæ, and of Combretum and Rhus predominate. The characteristic Cape Colony trees met with in the Mist-belt forest are absent, and the species show a closer relationship with those of the great "South Central" region of Tropical Africa. Epiphytes of all kinds and ferns are scarce.

For present convenience I have sub-divided this zone into two belts, that lying East of the Drakensberg and that to the West. In the list the 45 species which are common to both belts are marked 3 c., and those apparently confined to the Eastern or Western belt are marked 3 E. or 3 W. respectively, of which there are 38 in each. The figures will change somewhat, as regards the eastern or western middle veld, with the increasing knowledge of the distribution of species which we are gaining every day. For this we are indebted to the kind assistance of the Staff of the Division of Forestry, and to that of voluntary helpers and correspondents; among the latter we are particularly indebted to Mr. H. A. Baily, Mr. F. C. Menne, Rev. C. Reuter, Mr. H. S. Altenroxel and Mr. Geo. Thorncroft.

4. The Low veld zone. I have restricted the term low veld to the country lying below a contour line of about 1,500 feet alt., which, under favourable conditions, may perhaps rise to 1,800 feet alt. At present but little is known about its flora; it is a typical *Savannah Region*, like the middle veld, but my few visits show that although there are many species common to both, the low veld has a number of species peculiar to it; Palms (*Phœnix* and *Hyphœne*) are more abundant, and the presence of such trees as the Baobab (*Adansonia digitata*), Tambotie (*Excœcaria africana*), Lod-hout (*Combretum* sp.), Mopaane (*Copaifera mopane*) and Rhodesian Mahogany (*Afzelia quanzensis*) show a closer relationship to the flora of Equatorial Africa. The handsome epiphytic orchid *Ansellia africana* is common in the Mopaane trees. Only 27 species are here listed for this Region owing to the fact that I have seldom visited the low veld; it is but thinly populated with white people, and practically no agriculture is being carried on, so that my duties have rarely called me there, and I have not had time to make special visits.

Six species are aliens naturalised in the Transvaal.

There are forty-six species of which the zonal distribution is at present uncertain.

The species certainly known to occur in each Zone are here listed alphabetically for convenience of reference; their vernacular names and other particulars as to geographical range can be found on referring to the particular Family in the classified list at the end.

I.—MIST-BELT SPECIES.

1. Acacia ataxacantha, D. C. (28 Leguminosæ). Borders of Woods.
2. Allophylus sp. (*Schmidelia melanocarpa*, Arn.) (48 Sapindaceæ).
3. Aloe arborescens, Mill. (3 Liliaceæ). Dry summits of escarpments.
4. Apodytes dimidiata, E. Mey. (26 Icacinaceæ).
5. Brachylæna discolor, D. C. (19 Compositæ).
6. Buddleia salviaefolia, Lam. (29 Loganiaceæ). Also 2 and 3 c.
7. Burchellia capensis, D. C. (45 Rubiaceæ). Outside the forest.
8. Calodendrum capensis, Thunb. (46 Rutaceæ).
9. Cephalanthus natalensis, Oliv. (45 Rubiaceæ). Outside the forest.
10. Clausena inæqualis (Presl.) Oliv. (46 Rutaceæ).
11. Combretum Kraussii, Hochst. (18 Combretaceæ).
12. Curtisia faginea, Ait. (20 Cornaceæ).
13. Cussonia umbellifera, Sond. (10 Araliaceæ).
14. Cussonia sp. B. (10 Araliaceæ).
15. Cyathea Dregei, Kunze. (1 Cyatheaceæ). Along streams; also 2 and 3 c.
16. Ekebergia capensis, Sparrm. (31 Meliaceæ).
17. Faurea sp. nov. (42 Proteaceæ).
18. Ficus capensis, Thunb. (33 Moraceæ).
19. Ficus (natalensis, Hochst.?) (33 Moraceæ).
20. Gardenia Rothmannia, L. f. (45 Rubiaceæ).
21. Grumilea capensis, Sond. (45 Rubiaceæ).
22. Gymnosporia deflexa, Sprague. (17 Celastraceæ).
23. Halleria lucida, L. (50 Scrophulariaceæ). Also in 2.
24. Harpephyllum caffrum, Bernh. (6 Anacardiaceæ).
25. Hippobromus pauciflorus (L.) Radlk. (48 Sapindaceæ).
26. Kiggelaria africana, L. (24 Flacourtiaceæ). Also in 2.
27. Mæsa rufescens, A.DC. (34 Myrsinaceæ).
28. Nuxia floribunda, Benth. (29 Loganiaceæ).
29. Nuxia tomentosa, Sond. (29 Loganiaceæ).
30. Ochna arborea, Burch. (36 Ochnaceæ). Also in 2.
31. Ochna atropurpurea natalitia (Meisn.) Harv. (36 Ochnaceæ). Also in 2.
32. Ochna sp. (36 Ochnaceæ).
33. Ocotea bullata, E. Mey. (27 Lauraceæ).
34. Olea laurifolia, Lam. (38 Oleaceæ).
35. Olinia cymosa, Thunb. (39 Oliniaceæ).
36. Oxyanthus Gerrardi, Sond. (45 Rubiaceæ).
37. Pappea capensis, Eckl. & Zeyh. (48 Sapindaceæ). Also in 2.
38. Peddiea africana, Harv. (53 Thymeleaceæ).
39. Peucedanum fraxinifolium, Hiern. (56 Umbelliferæ). Also in 2.
40. Pittosporum viridiflorum, Sims. (40 Pittosporaceæ). Also in 2.
41. Plectronia sp. (*Canthium Gueinzii*, Sond.) (45 Rubiaceæ).
42. Podocarpus elongata, L'Hérit. (2 Taxaceæ).
43. P. Thunbergii, Hook. (2 Taxaceæ).
44. Ptæroxylon utile, Eckl. & Zeyh. (31 Meliaceæ).
45. Pygeum africanum, Hook. f. (44 Rosaceæ).
46. Rapanea melanophlœos (L.) Mez. (34 Myrsinaceæ).
47. Rawsonia lucida, Harv. & Sond. (24 Flacourtiaceæ).
48. Rhamnus prinoides, L'Hérit. (43 Rhamnaceæ). Also in 2.
49. Rhus lævigata, L. (6 Anacardiaceæ).
50. Schrebera alata, Welw. (38 Oleaceæ).
51. Scolopia Ecklonii (Arn.) Warb. (24 Flacourtiaceæ).
52. Syzygium sp. A. (*Acmena Gerrardi*, Harv.) (35 Myrtaceæ).
53. S. sp. B. "Drakensberg." (35 Myrtaceæ).
54. Teclea natalensis (Sond.) Engl. (46 Rutaceæ).
55. T. nobilis, Delile (46 Rutaceæ).
56. Toddalia lanceolata, D. C. (46 Rutaceæ).
57. Trema bracteolata, Blume (54 Ulmaceæ).
58. Tricalysia sp. (*Kraussia lanceolata*, Sond.) (45 Rubiaceæ).
59. Trichilia emetica, Vahl. (31 Meliaceæ). Also 3 E.
60. Trichocladus grandiflorus, Oliv. (25 Hamamelidaceæ).
61. Trimeria grandifolia (Hochst.) Warb. (24 Flacourtiaceæ).
62. Vaccinium exul, Bolus (22 Ericaceæ). Outside the forest.
63. Xanthoxylum capense, Harv. (46 Rutaceæ). Also 2.
64. Xymalos monospora (Harv.) Baill. (24 Flacourtiaceæ).

2.—HIGH-VELD TREES, OTHER THAN THOSE OF THE MIST-BELT.

1. Acacia horrida, Willd. (28 Leguminosæ).
2. A. eriadenia, Benth. (28 Leguminosæ).
3. Aloe arborescens, Mill. (3 Liliaceæ).
4. Buddleia salviaefolia, Lam. (29 Loganiaceæ).
5. Celtis rhamnifolia, Presl. (54 Ulmaceæ).
6. Chrysophyllum magalis-montanum, Sond. (49 Sapotaceæ).
7. Clerodendron glabrum, E. Mey. (57 Verbenaceæ).
8. Combretum glomeruliflorum, Sond. (13 Combretaceæ).
9. Cussonia sp. A. (10 Araliaceæ).
10. Cyathea Dregei, Kunze. (1 Cyatheaceæ). Kloofs of Magaliesberg.
11. Ehretia hottentotica, Burch. (13 Borraginaceæ). Kopjies.
12. Euclea lanceolata, E. Mey. (21 Ebenaceæ).
13. Greyia Sutherlandi, Hook. and Harv. (32 Melianthaceæ).
14. Kiggelaria africana, L. (24 Flacourtiaceæ).
15. Leucosidea sericea, Eckl. & Zeyh. (44 Rosaceæ).
16. Nuxia congesta, R. Br. (29 Loganiaceæ).
17. Ochna arborea, Burch. (36 Ochnaceæ).
18. Ochna atropurpurea natalitia (Meisn.) Harv. (36 Ochnaceæ).
19. Olea verrucosa, Link. (38 Oleaceæ).
20. Olinia cymosa, Thunb. (39 Oliniaceæ).
21. Peucedanum fraxinifolium, Hiern. (55 Umbelliferæ).
22. Pappea capensis. Eckl. & Zeyh. (48 Sapindaceæ). Magaliesberg.
23. Pittosporum viridiflorum, Sims. (40 Pittosporaceæ).
24. Plectronia Mundtiana, Pappe. (45 Rubiaceæ).
25. Protea curvata, N. E. Br. (42 Proteaceæ).
26. Protea hirta, Kl. (42 Proteaceæ).
27. Protea Rouppelliæ, Meisn. (42 Proteaceæ).
28. Rhamnus prinoides, L'Hérit. (43 Rhamnaceæ).
29. Rhus ciliata, Licht. (6 Anacardiaceæ).
30. R. divaricata fulvescens, E. & Z. (6 Anacardiaceæ).
31. R. puberula, E. & Z. (6 Anacardiaceæ).
32. R. viminalis, Vahl. (6 Anacardiaceæ).
33. R. Zeyheri, Sond. (6 Anacardiaceæ).
34. Royena pallens, Thunb. (21 Ebenaceæ).
35. R. Wilmsii, Gürke. (21 Ebenaceæ).
36. Salix capensis, Thunb. (4 Salicaceæ).
37. S. Wilmsii, Seem. (4 Salicaceæ).
38. Toddalia lanceolata, D. C. (46 Rutaceæ). Magaliesberg.
39. Urera tenax, N. E. Br. (56 Urticaceæ). Magaliesberg.
40. Vangueria infausta, Burch. (45 Rubiaceæ).
41. Xanthoxylum capense, Harv. (46 Rutaceæ).
42. Zizyphus mucronata, Willd. (43 Rhamnaceæ).

3.—SAVANNAH REGION.

E. Eastern Middle Veld (Savannah) Species.

(Only known to occur *East* of the Drakensberg.)

1. Acacia sp. N. "Molowha."
2. Adina Galpinii, Oliver (45 Rubiaceæ).
3. Anona senegalensis, Pers. (7 Anonaceæ).
4. Anthocleista insignis, Galpin. (29 Loganiaceæ).
5. Bauhinia (reticulata, D. C. ?) (28 Leguminosæ).
6. Combretum Galpinii, Engl. & Diels. (18 Combretaceæ).
7. Commiphora (molle, Engl. ?) (14 Burseraceæ).
8. Cordia abyssinica, R. Br. (13 Borraginaceæ).
9. Diospyros natalensis, A. D. C. (21 Ebenaceæ).
10. Diospyros mespiliformis, Hochst. (21 Ebenaceæ).
11. Ehretia amœna, Klotsch. (13 Borraginaceæ).
12. Erythrina tomentosa, R. Br. (28 Leguminosæ).
13. Excœcaria sp. (37 Euphorbiaceæ).
14. Euclea macrophylla, E. Mey. (21 Ebenaceæ).

15. Faurea speciosa, Welw. (42 Proteaceæ).
16. Ficus sp. A. (33 Moraceæ).
17. F. sp. D. (33 Moraceæ).
18. F. (lutea, Vahl?) (33 Moraceæ).
19. Gymnosporia fasciculata, Lœsen. (17 Celastraceæ).
20. Heteropyxis canescens, Oliv. (30 Lythraceæ).
21. Hyphæne ventricosa, Kirk. (5 Palmæ).
22. Kigelia pinnata, D. C. (11 Bignoniaceæ) up to 2,000 feet alt.
23. Musa (Livingstoniana, Kirk.?) (4 Musaceæ).
24. Parinarium mobola, Oliver. (44 Rosaceæ).
25. Pavetta disarticulata, Galpin. (45 Rubiaceæ).
26. Phoenix ventricosa, Kirk. (5 Palmæ).
27. Phyllanthus sp. (23 Euphorbiaceæ).
28. Protorhus longifolia, Engl. (6 Anacardiaceæ).
29. Salix Wilmsii, Seemen. (47 Salicaceæ).
30. Sterculia murex, Hemsl. (52 Sterculiaceæ).
31. Strelitzia augusta, Thunb. (4 Musaceæ).
32. Strychnos spinosa, Lam. (29 Loganiaceæ).
33. Syzygium cordatum, Hochst. (35 Myrtaceæ).
34. S. sp. (35 Myrtaceæ).
35. Terminalia phanerophlebia, Engl. & Diels (18 Combretaceæ).
36. Trichilia emetica, Vahl. (31 Meliaceæ).
37. Vitex reflexa, Pearson. (57 Verbenaceæ).

3 W.—*WESTERN MIDDLE-VELD SPECIES.*

(Only known to occur *West* of the Drakensberg.)

1. Acacia Burkei, Benth. (28 Leguminosæ).
2. A. detinens, Burch. (28 Leguminosæ).
3. A. ferox, Benth. (28 Leguminosæ).
4. A. Giraffæ, Burch. (28 Leguminosæ).
5. A. hebeclada, D. C. (28 Leguminosæ).
6. A. robusta, Burch. (28 Leguminosæ).
7. A. stolonifera, Burch. (28 Leguminosæ).
8. A. sp. F. (28 Leguminosæ).
9. Albizzia (Lebbek Benth?) (28 Leguminosæ).
10. Aloe (ferox, Mill.?) (3 Liliaceæ).
11. Burkea africana, Willd. (28 Leguminosæ).
12. Chrysophyllum magalis-montanum, Sond. (49 Sapotaceæ).
13. Combretum hereroense vilosissimum, Engl. & Diels. (18 Combretaceæ).
14. Commiphora Rehmanni, Engl. (14 Burseraceæ).
15. Cussonia natalensis, Sond. (10 Araliaceæ).
16. Elæodendron æthiopicum pubescens, Oliver. (17 Celastraceæ).
17. E. Rehmanni, Szyszyl. (17 Celastraceæ).
18. Euclea lanceolata, E. Mey. (21 Ebenaceæ).
19. Euphorbia (angularis, Klotzsch?) (37 Euphorbiaceæ).
20. E. (elastica, Jumelle?). (37 Euphorbiaceæ).
21. Ficus capensis, Thunb. (32 Moraceæ).
22. F. cordata, Thunb. (32 Moraceæ).
23. F. sp. B. (32 Moraceæ).
24. Mimusops obovata, Sond. (49 Sapotaceæ).
25. M. Zeyheri, Sond. (49 Sapotaceæ).
26. Ochna pulchra, Hook. (36 Ochnaceæ).
27. O. Rehmanni, E. Mey. (36 Ochnaceæ).
28. Pseudocedrela sp. nov. (31 Meliaceæ).
29. Rhus coriacea, Engl. (6 Anacardiaceæ).
30. R. incana, Engl. (6 Anacardiaceæ).
31. R. lancea, L.f. (6 Anacardiaceæ).
32. Rhus villosa, L. (6 Anacardiaceæ).
33. R. viminalis, Vahl. (6 Anacardiaceæ).
34. Royena pallens, Thunb. (21 Ebenaceæ).
35. Securidaca longipedunculata, parviflora, Oliv. (41 Polygalaceæ).
36. Sideroxylon inerme, L. (49 Sapotaceæ).
37. Strychnos pungens, Solereder. (29 Loganiaceæ).
38. Vitex Zeyheri, Sond. (57 Verbenaceæ).

C.—*COMMON TO BOTH EASTERN AND WESTERN BELTS.*

1. Acacia arabica Kraussiana, Benth. (28 Leguminosæ).
2. A. caffra, Willd. (28 Leguminosæ).
3. A. horrida, Willd. (28 Leguminosæ).
4. A. nigrescens pallens, Benth. (28 Leguminosæ).
5. A. (spirocarpa, Hochst.?) (28 Leguminosæ).
6. A. sp. G. (28 Leguminosæ).
7. A. sp. H. "Mun-yaa." (28 Leguminosæ).
8. A. sp 1. (28 Leguminosæ).
9. A. sp. K. (28 Leguminosæ).
10. Adansonia digitata (B. Juss.) L. (12 Bombacaceæ).
11. Bolusanthus speciosus (Bolus) Harms. (28 Leguminosæ).
12. Buddleia salviæfolia, Lam. (29 Loganiaceæ).
13. Clerodendron glabrum, E. Mey. (57 Verbenaceæ).
14. Combretum apiculatum, Sond. (18 Combretaceæ).
15. C. glomeruliflorum, Sond. (18 Combretaceæ).
16. C. Gueinzii, Sond. (18 Combretaceæ).
17. C. porphyrolepis, Engl. & Diels. (18 Combretaceæ).
18. C. Zeyheri, Sond. (18 Combretaceæ).
19. Cyathea Dregei, Kunze. (1 Cyatheaceæ).
20. Dichrostachys nutans, Benth. (28 Leguminosæ).
21. Dombeya rotundifolia, Harv. (52 Sterculiaceæ).
22. Ehretia hottentotica, Burch. (13 Borraginaceæ).
23. Erythrina caffra, Thunb. (28 Leguminosæ).
24. Euclea undulata, Thunb. (21 Ebenaceæ).
25. Euphorbia Reinhardtii, Volkens. (37 Euphorbiaceæ).
26. Faurea saligna, Harv. (42 Proteaceæ).
27. Gardenia Thunbergia, L. f. (45 Rubiaceæ).
28. Heeria paniculosa (Sond.) O. Ktze. (6 Anacardiaceæ).
29. Heteropyxis natalensis, Harv. (30 Lythraceæ).
30. Ilex capensis, Sond. (9 Aquifoliaceæ).
31. Kirkia sp. nov. (51 Simarubaceæ).
32. Lannea sp. (*Odina discolor*, Sond.) (6 Anacardiaceæ).
33. Olea verrucosa, Link. (38 Oleceæ).
34. Peltophorum africanum, Sond. (28 Leguminosæ).
35. Protea Rouppelliæ, Meisn. (42 Proteaceæ).
36. Pterocarpus angolensis, D. C. (28 Leguminosæ).
37. P. sericeus, Benth. (28 Leguminosæ).
38. Rhamnus Zeyheri, Sond. (43 Rhamnaceæ).
39. Sclerocarya caffra, Sond. (6 Anacardiaceæ). .
40. Schotia transvaalensis, Rolfe. (28 Leguminosæ).
41. Terminalia sericea, Burch. (28 Leguminosæ).
42. Vangueria infausta, Burch. (45 Rubiaceæ).
43. Vitex Wilmsii, Guerke. (57 Verbenaceæ).
44. Ximenia caffra, Sond. (37 Olacaceæ).
45. Zizyphus mucronata, Willd. (43 Rhamnaceæ).

4.—LOW VELD SPECIES.

1. Acacia nigrescens pallens, Benth. (28 Leguminosæ).
2. A. spirocarpa, Hochst. (28 Leguminosæ).
3. A. (verugera, Schweinf?) (28 Leguminosæ).
4. A. sp. D.
5. A. sp. M.
6. Adansonia digitata (B. Juss.) L. (12 Bombacaceæ).
7. Afzelia quanzensis, Welw. (28 Leguminosæ).
8. Albizzia versicolor, Welw. (28 Leguminosæ).
9. Bolusanthus speciosus (Bolus) Harms. (28 Leguminosæ).
10. Combretum porphyrolepis, Engl. & Diels. (28 Leguminosæ).
11. C. tenuipes, Engl. & Diels. (28 Leguminosæ).
12. Copaifera mopane, Kirk. (28 Leguminosæ).
13. Diospyros mespiliformis, Hochst. (21 Ebenaceæ).
14. Euclea divinorum, Hiern. (21 Ebenaceæ).
15. Excœcaria africana, Muell. (37 Euphorbiaceæ).
16. Ficus sp. F. (32 Moraceæ).
17. Gardenia Saundersiæ, N. E. Br. (45 Rubiaceæ).
18. Hyphæne ventricosa, Kirk. (5 Palmæ).

19. Kigelia pinnata (Jacq.) D. C. (11 Bignoniaceæ).
20. Peltophorum africanum, Sond. (28 Leguminosæ).
21. Phœnix reclinata, Jacq. (5 Palmæ).
22. Pterocarpus angolensis, D.C. (28 Leguminosæ).
23. Sclerocarya caffra, Sond. (6 Anacardiaceæ).
24. Sideroxylon inerme, L. (49 Sapotaceæ).
25. Syzygium cordatum, Hochst. (35 Myrtaceæ).
26. Terminalia sericea, Burch. (18 Combretaceæ).
27. Zizyphus mucronata, Willd. (43 Rhamnaceæ). Also in 2 and 3.

5.—SPECIES OF UNCERTAIN ZONAL RANGE.

1. Acacia Gerrardi, Benth. (28 Leguminosæ).
2. A. uncinata, Engl. (28 Leguminosæ).
3. Acocanthera venenata, G. Don. (8 Apocynaceæ).
4. Adina microcephala, Hiern. (45 Rubiaceæ).
5. Buddleia auriculata, Benth. (29 Loganiaceæ).
6. Chilianthus dysophyllus, Benth. (29 Loganiaceæ).
7. Chrysophyllum Wilmsii, Engl. (49 Sapotaceæ).
8. Combretum erythrophyllum, Sond. (18 Combretaceæ).
9. C. Galpinii, Engl. & Diels. (18 Combretaceæ).
10. C. lydenburgianum, Engl. & Diels. (18 Combretaceæ).
11. C. suluense, Engl. & Diels (18 Combretaceæ).
12. Commiphora (molle, Engl.?) (14 Burseraceæ).
13. Dalbergia armata, E. Mey. (28 Leguminosæ).
14. Ekebergia Meyeri, Presl. (31 Meliaceæ).
15. Elæodendron confertifolium leptocarpum, Sond. (17 Celastraceæ).
16. Ficus Burkei, Miq. (33 Moraceæ).
17. Gardenia Gerrardiana, Harv. & Sond. (45 Rubiaceæ).
18. G. Neuberia, Eckl. & Zeyh. (45 Rubiaceæ).
19. Gerrardina foliosa, Oliv. (24 Flacourtiaceæ).
20. Greyia Radlkoferi, Szyszyl. (32 Melianthaceæ).
21. Gymnosporia condensata, Sprague. (17 Celastraceæ).
22. Heeria sp. (*Rhus salicina*, Sond.) (6 Anacardiaceæ).
23. Hemitelia capensis, R. Br. (1 Cyatheaceæ).
24. Heteromorpha arborescens, Ch. & Schl. (55 Umbelliferæ).
25. Kiggelaria (Dregeana, Turcz.?) (24 Flacourtiaceæ).
26. Leucospermum Zeyheri, Meisn. (42 Proteaceæ).
27. Lonchocarpus capassa, Rolf. (28 Leguminosæ).
28. Mærua sp. (*Niebuhria triphylla*, Wendl.) (16 Capparidaceæ).
29. Protea (lanceolata, E. Mey.?) (42 Proteaceæ).
30. Pterocelastrus Galpinii, Loesen. (17 Celastraceæ).
31. Rhus acutidens, Engl. (6 Anacardiaceæ).
32. R. Burkeana, Sond. (6 Anacardiaceæ).
33. R. discolor, E. Mey. (6 Anacardiaceæ).
34. Rhus glaberrima, Engl. (6 Anacardiaceæ).
35. R. glaucovirens, Engl. (6 Anacardiaceæ).
36. R. magalis-montana, Sond. (6 Anacardiaceæ).
37. R. mucronata, Thunb. (6 Anacardiaceæ).
38. R. pyroides, Burch. (6 Anacardiaceæ).
39. R. Rehmanniana, Engl. (6 Anacardiaceæ).
40. R. Sonderi, Engl. (6 Anacardiaceæ).
41. R. Transvaalensis, Engl. (6 Anacardiaceæ).
42. Tricalysia Galpinii, Schinz. (45 Rubiaceæ).
43. T. sp. (*Bunburya capensis*, Meisn.) (5 Rubiaceæ).
44. Trichilia pterophylla C. D. C. (31 Meliaceæ).
45. T. (capitata, Klotzsch?) (31 Meliaceæ).
46. Vangueria latifolia, Sond. (45 Rubiaceæ).

6.—EXOTIC SPECIES, NATURALISED IN THE COLONY.

1. Acacia dealbata, Willd. (28 Leguminosæ).
2. A. decurrens mollis, Lindl. (28 Leguminosæ).
3. A. melanoxylon, R. Br. (28 Leguminosæ).
4. Eucalyptus globulus, L'Hérit. (35 Myrtaceæ).
5. E. viminalis, Labill. (35 Myrtaceæ).
6. Maclura aurantiaca, Nutt. (33 Moraceæ).
7. Melia Azedarach, L. (31 Meliaceæ).

8. Opuntia ficus-indica, Mill. (15 Cactaceæ).
9. Populus alba canescens, Loud. (47 Salicaceæ).
10. Prunus persica, Gmel. (44 Rosaceæ).
11. Ricinus communis, L. (23 Euphorbiaceæ).
12. Salix babylonica, L. (47 Salicaceæ).

LIST OF THE TREES OF THE TRANSVAAL.

The Families are arranged alphabetically under their main Divisions and Classes.

The Numbers of the *Families* placed within brackets are the consecutive numbers corresponding with those in the writer's "*List of the Families of Transvaal Plants.*" These indicate the taxonomic sequence of the families.

The numbers of the *Genera* placed within brackets are the consecutive numbers corresponding with those given by De Dalla Torre and Harms in the "*Genera Siphonogamarum.*"

Numbers *after* the names indicate the phyto-geographical distribution of the species, thus :—(1)=Mist Belt Forest; (2)=High Veld west of the Drakensberg; (3)=Middle Veld Savannah; E.=East of Brakensberg; W.=West of Drakensberg; C.=Common to the E. and W.; (4)=Low Veld; (5)=Zonal range uncertain; (6)=Exotic species naturalised in the Transvaal.

Parentheses around specific and varietal names indicate some uncertainty as to identification, owing to incomplete material or lack of literature.

GROUP I.—PTERIDOPHYTA (VASCULAR CRYPTOGAMS).

CLASS FILICALES (FERNS).

1. Cyatheaceæ; Tree-fern Family.

1 (1) *Cyathea*, Smith.

1. Dregei, Kunze. Common Tree-fern; isi-Hihi. 1, 2, 3c. Along streams and borders of forests in the mist belt; extending westward to shady kloofs of the Magaliesberg, Witwatersrand and Waterberg.

2 (2) *Hemitelia*, R. Br.

2. (capensis, R. Br.?). Slender Tree-fern. 5. Reported from waterfalls in the um-Lomatie valley near Barberton.

GROUP II.—SPERMAPHYTA (PHANEROGAMS).

DIVISION I.—GYMNOSPERMÆ.

CLASS CONIFERÆ (CONIFERS).

2 (5) Taxaceæ, Lindl.; D.T.H. 2; Yew-tree Family.

3 (13) *Podocarpus*, L'Hérit. African Yellow-woods.

3. elongata, L'Hérit. (*P. pruinosa*, E. Mey.) Smooth-barked, Bastard or Outeniqua Yellow-wood, Geelhout, Mutzaugera (Kikuyu), um-Koba (Zulu). 1. Forests of the Drakensberg.

falcata, R. Br.=P. Thunbergii falcata R. Br. (Sim).

latifolia, R. Br.=P. Thunbergii, Hook.

pruinosa, E. Mey.=P. elongata, L'Hérit.

4. Thunbergii, Hook. (*P. latifolia*, R. Br.). Rough barked, True, Common or Upright Yellow-wood, um-Sunti (Zulu). 1. Forests of the Drakensberg. (b. falcata (R. Br.) Sim?) (*P. falcata*, R. Br.) 5.

DIVISION II.—ANGIOSPERMÆ.

CLASS 1.—MONOCOTYLEDONES.

3 (38) Liliaceæ, Hall.; D.T.H. 60; Fl. Cap. 6: 253. Lily Family.

4 (1026) *Aloe* (Tourn.) L. Aloes.

5. arborescens, Mill. i-Kalana (Kaff.) 1, 2. Dry summits of escarpments in the Drakensberg, 4,100 to 4,800 feet.
6. (ferox, Mill.?). 2, 3 W. Rocky kopjies of the Middle and High Veld from Barberton to Ottoshoop, 4,100 to 5,700 feet.
7. Bainesii, Dyer. 3 E. Baine's Aloe. Dry rocky slopes of kloofs at Barberton.

4 (56) Musaceæ, J. St. Hil.; D.T.H. 84. Banana Family.

5 (1318) *Musa*, L.; Bananas; Piesang.
8. (Livingstoniana, Kirk.?); Wild Banana; Wilde Piesang; Mateela. 3 E. Along streams on the eastern slope of the Drakensberg from 4,800 feet down to about 2,800 feet.
6 (1319) *Strelitzia*, Banks.; Bird-of-Paradise Flower.
9. (augusta, Thunb.?). 3 E. Rocky ridges of the Drakensberg in the Zoutpansberg and in Swaziland.

5 (21) Palmæ, L.; D.T.H. 37; Fl. Cap. 7: 28. Palm Family.

7 (528) *Phoenix*, L.; Date-palms.
10. reclinata, Jacq.; Wild Date-palm. 4. River banks of the Low Veld.
8 (553) *Hyphæne*, Gærtn.; Doum-palms.
11. ventricosa, Kirk.; Wild Fan-palm. 3 E.; (4?) Plains of the Groot Letaba, Thabina and Selati Rivers, Zoutpansberg.

Class 2.—Dicotyledones.

6 (153) Anacardiaceæ, Lindl.; D.T.H. 285. (Terebintaceæ, Fl. Cap. 1: 502).

Anaphrenium, E. Mey.=Heeria, Meissn.
A. longifolium, Bernh.=Protorhus longifolia (Bernh.) Engler.
9 (4562) *Harpephyllum*, Bernh.
12. caffrum, Bernh.; Kafir Plum, Sour Plum, Zuure pruim; Kafir date; um-Gwenge; 1. Shady kloofs at Barberton.
10 (4589) *Heeria*, Meisn. (*Anaphrenium*, E. Mey.).
13. paniculosa (Sond.) O. Ktze. (*Rhus paniculosa*, Sond.; *Anaphrenium paniculosum* (Sond.) Engl.); "Respies." 3 c. Pretoria, Waterberg and Zoutpansberg Districts.
14. sp. (*Rhus salicina*, Sond.) 5. Magaliesberg.
11 (4563) *Lannea*, A. Rich. (*Odina*, Roxb.)
15. sp. (*Odina discolor*, Sond.) 3 c. Magaliesberg and Waterberg; Zoutpansberg and Barberton Districts.
Odina, Roxb.=Lannea, A. Rich.
12 (4576) *Protorhus*, Engl.
16. longifolia (Bernh.) Engl. (*Rhus longifolia* (Bernh.) Sond.; *Anaphrenium longifolium*, Bernh.); "Honone"; isi-Fuce (Zulu). 3 E.; 4. Barberton; Komatie poort.
13 (4594) *Rhus* (Tourn.) L.
17. acutidens, Engl. 5. "Houtbosch."
18. Burkeana, Sond. Burke's Rhus. 5. "Aapjies River."
19. ciliata, Licht. 2. Rhenosterkop; near Vaal River.
20. coriacea, Engl. 3 W. Klip-pan (Bush-veld); Pretoria.
21. discolor, E. Mey. 5. Magaliesberg; Sterk-hill, Lydenburg.
22. divaricata fulvescens, Eckl. & Zeyh. 2. Trigardsfontein.
23. glaberrima, Engl. 5. Pretoria.
24. glaucovirens, Engl. 5. Pretoria.
25. incana, Engl. 3 W. Klip-pan; Eland's River.
26. lævigata, L.; "Bosch taai-bosch"; Kirie hout; Western Esschenhout; Bosganna; Red currant; um-Klakoti (Cape). 1. Houtboschberg and near Barberton; outside of "Bush."
27. lancea, L.f. 3 W. Magaliesberg; Waterberg; Zeerust.
longifolia (Bernh.)=Protorhus longifolia (Bernh.) Engl.
28. magalis-montana, Sond. Magaliesberg Rhus. 5. Magaliesberg.
29. mucronata, Thunb. 5. Magaliesberg.
paniculosa, Sond.=Heeria paniculosa (Sond.) O. Ktze.
30. puberula, E. & Z. 2. Johannesburg.
31. pyroides, Burch. 5. Barberton.
32. Rehmanniana, Engl. Rehmann's Rhus. 5. "Houtbosch."
salicina, Sond.=Heeria sp.
33. Sonderi, Engl. Sonder's Rhus. 5. Barberton.
b. glaberrima, Engl. Pretoria.
c. pilosa, Engl. Pretoria.
d. pilosissima, Engl. "Page's Hotel."

34. transvaalensis, Engl. Transvaal Rhus. 5. "Houtbosch."
35. villosa, L. 3 W. Pretoria; Makapansberg; Klip-pan; Houtbosch; Schweizer Reneke.
b. gracilis, Engl. Pretoria.
36. viminalis, Vahl.; Karee-boom; Karoo wood. 2; 3 W. Eland's River; Neu Halle; Houtbosch.
37. Zeyheri, Sond. Zeyher's Rhus. 2. Magaliesberg; Pretoria; Johannesburg.
14 (4558) *Sclerocarya*, Hochst.
38. caffra, Sond.; "Maroola"; Meroola; um-Ganu. T.A.J. Vol. iii., No. 9 Pl. xv. 3 C; 4. Magaliesberg; Waterberg; Zoutpansberg and Barberton Districts; Komatie-poort.
b. dentata, Engl. 3 C. Pretoria; between Eland's River and Klip-pan; near Leydsdorp.

7 (98) Anonaceæ, L. C. Rich.; D.T.H. 172; Fl. Cap. 1: 7 Custard-apple Family.

15 (2729) *Anona*, L.
30. senegalensis, Pers.; Wild Custard-apple; Maiolo, Malolo; Mooaa' be (Sesutu). 3 E.; (4?). East of the Drakensberg; Zoutpansberg south to Barberton and Swaziland.

8 (247) Apocynaceæ, Lindl.; D.T.H. 404.

16 (6558) *Acokanthera*, G. Don.
40. venenata, G. Don.; Kaffir Gieft-boom. 5. Near Johannesburg.

9 (157) Aquifoliaceæ, D. C.; D.T.H. 288; Fl. Cap. 1: 472. Holly Family.

17 (4614) *Ilex* (Tourn.) L.; Hollies.
41. capensis, Sond.; White wood; Wit-hout; um-Duma; Water-tree. 3 C.

10 (227) Araliaceæ, Vent.; D.T.H. 363; Fl. Cap. 2: 568. Ivy Family.

18 (5872) *Cussonia*, Thunb.; Cabbagewood; Kippersol; Samareelboom.
42. natalensis, Sond. 3 W. Potgieter; Smits Drift Valley.
43. umbellifera, Sond.; Cabbage wood; Muvsaaje (Sesutu). 1. Forests of the Drakensberg.
44. sp. A. 2. Common on kopjies of the High Veld at Pretoria, Johannesburg, etc.
45. sp. B. 1. Houtboschberg forests.

11 (258) Bignoniaceæ, Pers.; D.T.H. 465; Fl. Cap. 4: Sec. 2. p. 447. Bignonia Family.

19 (7761) *Kigelia*, D. C.
46. pinnata (Jacq.) D. C.; Bologna-sausage tree, German-sausage tree. um-Fougote (Zulu), um-Zenguka (Zulu); Kigel-keia; 3 E; 4. Barberton; Thabina.

Bixaceæ. Fl. Cap. 1: 65. = Flacourtiaceæ.

12 (177) Bombacaceæ, K. Schum.; D.T.H. 309. Kapok Family.

20 (5023) *Adansonia*, L.
47. digitata, L.; Baobab; Cream-of-Tartar tree, Lemonade tree, Tartaric-acid tree; Shimuhu (Shangaan); Mowana, Mucua (Angola); Bread-tree; N'Bondo; Imbondeiro. Plate clxix. See T.A.J., Vol. iv., No. 13, Pl. vii. 3 C 4. Blaauwberg; Duivels Kloof; near Leydsdorp; old Delagoa Road from Leydsdorp; Oliphant's River below Ohrigstad. About 4 only are said to occur in the Game Reserve south of the Oliphant's River. Plentiful north of the Letaba on the Tende, Susquietjie and Maluyan Spruits, and all the way up to the Limpopo (H. Wolhuter).

13 (252) Borraginaceæ, Lindl.; D.T.H. 424. Boragineæ Fl. Cap. 4: Sec. 2, p. 2. Borage Family.

21 (7038) *Cordia*, L.
48 abyssinica, R. Br.; M'Tadola. Plate clxx. 3 E. Tzaneen.
22 (7043) *Ehretia*, L.
49. amœna, Klotzsch. 3 E. Avoca near Barberton.
50. hottentotica, Burch. 2, 3 C. near Barberton; Spitzkop; Johannesburg.

Buettneriaceæ = Sterculiaceæ.

14 (139) Burseraceæ Kunth.; D.T.H. 258.

23 (4151) *Commiphora*, Jacq.

51. (molle, Engl.?). 3 E. Crocodile-poort, Barberton District.
52. Rehmanni, Engl. 3 W. Klippan.

Byttneriaceæ, R. Br.; Fl. Cap. 1: 179 = Sterculiaceæ.

15 (210) Cactaceæ, Lindl.; D.T.H. 335. Prickly-pear Family.

24 (5417) *Opuntia* (Tourn.) Mill.

53. *Ficus-indica*, Mill.; Prickly pear. 6. An "escape"; Klerksdorp, Marico, Rustenburg, Pretoria, Waterberg, Middelburg and Zoutpansberg Districts.

16 (107) Capparidaceæ, Lindl.; D.T.H. 192; Fl. Cap. 1: 54. Caper Family.

25 (3112) *Mærua*, Forsk.

54. sp. (*Niebuhria triphylla*, Wendl.) Wit-boschhout. 5. Barberton; Swaziland.

Niebuhria, D. C. = Mærua, Forsk.

17 (158) Celastraceæ, Lindl.; D.T.H. 289; Celastrineæ, Fl. Cap. 1:451. Celastrus Family.

Celastrus, L. in part (= Gymnosporia, Benth.)

26 (4640) *Elæodendron*, Jacq. f.

55. æthiopicum pubescens, Oliv.; Lepelhout, Spoonwood. 3 W. Magaliesberg at Crocodile River.
56. confertifolium leptocarpum, Sond. 5. Houtbosch (altitude ?).
57. Rehmanni, Szyszyl.; Rehmann's Spoonwood. 3 W. Pretoria.

27 (4627) *Gymnosporia*, Benth. & Hook. f.

58. acuminata (L.) Szyszyl. (not of Hook.); Silk bark, Zybast, Zydebast, um-Nama. 1. Houtbosch; Swaziland.
59. condensata, Sprague. 5. Oliphant's River.
60. deflexa, Sprague.; Transvaal Saffraan. 1. Drakensberg Forests.
61. fasciculata, Loesen. 3 E. Barberton.

Mystroxylon burkeanum, Sond. = Elæodendron aethiopicum pubescens, Oliv.

28 (4630) *Pterocelastrus*, Meissn.

62. Galpinii, Lœsen. 5. Barberton.

18 (221) Combretaceæ, R. Br.; D.T.H. 345; Fl. Cap. 2: 507. Combretum Family.

29 (5538) *Combretum* (L.) Loefl.

63. apiculatum, Sond. 3 C. Magaliesberg; Makapansberg; Barberton; Waterberg District.
64. erythrophyllum, Sond. Roodeblaad; Gelbholzbaum; Rooi-bosch. 5. "Barberton; Smith's Drift."
65. Galpinii, Engl. and Diels.; Galpin's combretum. 3 E. Kaap River. Barberton.
66. glomeruliflorum, Sond. River combretum. 2. 3 c. Along rivers, Pretoria, Barberton, Eland's River, Magaliesberg.
67. Gueinzii, Sond. Gueinzius' Rooibosch, Mookooba (Modjajies) 3 C. Magaliesberg; Komatie River; Letaba River.
68. hereroense villosissimum, Engl. & Diels. 3 W. Makapansberg.
69. Kraussii, Hochst.; Krauss's combretum; Vaterlands Wilge. 1. Forests of the Drakensberg.
70. lydenburgianum, Engl. & Diels.; Lydenburg combretum, 5. Lydenburg.
71. porphyrolepis, Engl. & Diels.; "Leadwood," im-Pondo-in-Dhlovu. 3 C. 4. Barberton; Makapansberg; Komatie-poort.

riparium, Sond. = C. glomeruliflorum, Sond.

72. suluense, Engl. & Diels. Horo combretum, 5. Swaziland.
73. tenuipes, Engl. & Diels. 4. Loeuw's Creek.
74. Zeyheri, Sond. Zeyher's Rooibosch. T.A.J., Vol. iv., No. 16. Pl. cxii. 3 C. Magaliesberg; Makapansberg; Barberton; near Leydsdorp; Waterberg.

30 (5544) *Terminalia*, L.

75. phanerophlebia, Engl. & Diels. 3 E, 4. Barberton; Komatiepoort; Nelspruit; Delagoa Bay.
76. sericea, Burch.; Bosch Vaal-bosch; Mawsawsso; Moumba (Suaheli); Nkonola (Delagoa); Musia (Angola). 3 C, 4. Magaliesberg; Makapansberg; Zeerust; near Leydsdorp; Barberton; near Komatiepoort.

19 (280) Compositæ, Vaill.; D.T.H. 523; Fl. Cap. 3: 44. Daisy Family.

31 (8936) ***Brachylæna***, **R. Br.**

77. discolor, D. C.; Forest Vaal-bosch. 1. Forests of the Drakensberg.

20 (229) Cornaceæ, Link.; D.T.H. 378; Fl. Cap. 2: 570. Dogwood Family.

32 (6156) ***Curtisia***, Ait.

78. faginea, Ait.; Assegai-hout, Assegai wood, Assegai; um-Yxina, um-Guna, om-Hlebe (Kaffir). 1. Forests of the Drakensberg.

21 (240) Ebenaceæ, Vent.; D.T.H. 395; Fl. Cap. 4: Sec. 1, 444. Ebony-wood Family.

33 (6406) ***Diospyros***, L.

79. mespiliformis, Hochst.; Hill matome, Musolveira. 3 E, 4. Komatiepoort; Crocodile-poort; near Leydsdorp; Spelonken.

34 (6404) ***Euclea***, Murr.

80. divinorum, Hiern. 4. near Loeuw's Creek, Barberton, 1,400 feet.

81. lanceolata, E. Mey.; Bosch Guarri; um-Gwali; i-Yezalokuxaxazisa. 2; 3 W. Magaliesberg; Johannesburg; near Middelburg; Bush Veld.

82. macrophylla, E. Mey. 3 E. Kaap Valley, 2,000 feet.

83. natalensis, A. D. C.; um-Tungamusi; Nhlangulane. 3 E, 4. near Barberton, 2,200 feet.

84. undulata, Thunb. Kressenreef. 3c. Magaliesberg; Blaauwberg; Waterberg; Barberton; near Wolmaransstad; Ottoshoop.

35 (6403) ***Royena***, L.

85. pallens, Thunb. "Blaauwbosch." 3 W; 2. Johannesburg; Klerksdorp; Bloemhof.

86. Wilmsii, Gurke. 2. Near Pretoria and Greylingstad.

22 (233) Ericaceæ, D.C.; D T.H. 380. Vacciniaceæ, Fl. Cap. 4: Sec. 1, p. 1. Heath Family.

36 (6216) ***Vaccinium***, L.

87. exul, Bolus. "Blueberry." 1. Outside the forests of the Drakensberg.

23 (147) Euphorbiaceæ, J. St. Hil.; D.T.H. 268. Euphorbia Family.

37 (4498) ***Euphorbia***, L.

88. (angularis, Klotzsch.?) T.A.J., Vol. iv. No. 14, Pl. xxxviii.; 3 W. Between Hænertsburg and Pietersburg; Buffelspoort near Rustenburg.

89. Reinhardtii, Volkens; Naboom; M'Hlonhlo; um'Hlonhlo. 3 C. Waterberg, Zoutpansberg and Barberton Districts.

90. sp. A. (E. elastica, Jumelle?). 3 W. Near Potgieter.

38 (4478) ***Excæcaria***, L.

91. africana, Muell. Arg.; um-Tambotie. Plate clxxv. 4. Loeuw's Creek near Barberton; Le Bombo Flats, Swaziland; Zoutpansberg District.

39 (4299) ***Phyllanthus***, L.

92. sp. 3 E. near Leydsdorp; Loeuw's Creek, Barberton.

40 (4424) ***Ricinus*** (Tourn), L.

93. communis, L. Common castor oil bush; 6. Barberton; Lydenburg and Zoutpansberg Districts.

b. *lividus*, Jacq. Scarlet podded Castor-oil bush. 6. Pretoria.

24 (199) Flacourtiaceæ, Dumort.; D T.H. 327. Bixaceæ. Fl. Cap. 1:65.

41 (5312) ***Gerrardina***, Oliv.

94. foliosa, Oliv. 5. Barberton; Natal.

42 (5296) ***Kiggelaria***, L.

95. africana, L.; Spek-hout; um-Paat; um-Veti (Zulu); Kersenhout, Pork wood; Natal Mahogany, Vaal Willow, Vaterlands Rooi-hout or Roode-hout. 1, 2. Drakensberg Forests; Standerton; Johannesburg; Pretoria.

96. (Dregeana, Turcz.?); Vaterlands Rooi-hout. 5 "Barberton."

Myroxylon, Forst. (in part) = Xymalos, Baill.

Phoberos, Lour. = Scolopia, Schreb.

43 (5275) ***Rawsonia***, Harv. & Sond.

97. lucida, Harv. & Sond.; Sapatha-naari (Modjajies). 1. Forests of the Drakensberg.

44 (5304) *Scolopia*, Schreb. (*Phoberos*, Lour.)
98. Ecklonii (Arn.) Warb.; Red-pear; Roode-pyr; Berg saffraan; i-Quamza, 1. Houtboschberg forests.
45 (5315) *Trimeria*, Harv.
alnifolia, Planch. = T. grandifolia (Hochst.) Warb.
99. grandifolia (Hochst.) Warb. 1. Drakensberg forests.
Xylosma, Forst. f. in part = Xymalos, Baill.
46 (——?) *Xymalos*, Baill. (*Xylosma*, Forst. f. in part).
100. monospora (Harv.) Baill.; Lemonwood; Boari; Bog-a-bog; u-Veto (Zulu); Lamuni (Kaffaria); Morawbya. Plate clxxi. 1. Houtboschberg forests.

25 (123) Hamamelidaceæ, Lindl.; D.T.H. 205; Fl. Cap. 2: 324.

47 (3311) *Trichocladus*, Pers.
101. grandiflorus, Oliv.; Underwood, Onderbosch. 1. Barberton; Pilgrim's Rest.

26 (162) Icacinaceæ, Miers.; D.T.H. 292 (Olacineæ Fl. Cap. 1: 234 in part).

48 (4686) *Apodytes*, E. Mey.
102. dimidiata, E. Mey.; White pear, Wit pyr, Figueira brava (Angola); um-Dakana. 1. Forests of the Drakensberg.

27 (102) Lauraceæ, Lindl.; D.T.H. 176; Laurel Family.

49 (2788) *Ocotea*, Aubl. (*Oreodaphne*, Nees & Mart. in part).
103. bullata, E. Mey.; Black Stinkwood; Laurel-wood. Plate clxxii. 1. Drakensberg forests.

Oreodaphne, Nees & Mart. in part = Ocotea, Aubl.

28 (128) Leguminosæ, Juss; D.T.H. 212; Fl. Cap. 2: 1. Pea Family.

Sub-family 1. Mimosoideæ; Fl. Cap. 2:276.

50 (3446) *Acacia* (Tourn.) Willd.
104. arabica Kraussiana, Benth. Gum arabic tree. 3c; 4. Pretoria, Potgieter, Leydsdorp, Loeuw's Creek.
105. ataxacantha, D. C. 1. Borders of forests at Hænertsburg and Pilgrim's Rest.
106. Burkei, Benth.; Burke's thorn. 3 W. Magaliesberg.
107. caffra, Willd.; Kaffir wacht-n-bietjie; Cat-thorn, Magaala; Makaala; um-Yamanzi. 3 C. Pretoria, Leydsdorp.
108. *dealbata*, Willd.; Silver wattle. 6. An "escape," Godwan River, Mac-a-Mac, Johannesburg.
109. *decurrens mollis*, Lindl.; Black wattle. 6. An "escape," Athole, etc.
110. detinens, Burch.; Western Wacht-'n-bietje; Western Wait-a-bit. 3 W. Near Christiana.
111. eriadenia, Benth. 2. Crocodile River at the Magaliesberg; Barberton.
erioloba, E. Mey. = A. Giraffæ, Burch.
112. ferox, Benth. 3 W. Magaliesberg.
113. Gerrardi, Benth.; Gerrard's thorn. 5. Barberton.
114. giraffæ, Burch.; Kameel-doorn, Giraffe thorn, Mookaaba (Cape). 3 W. Potgieter; Schweizer Reneke.
115. hebeclada, D. C. 3 W. Pretoria; Warm Baths; Potgieter; Sand River, Zoutpansberg.
116. horrida, Willd.; Mimosa, Zoet-doorn; Thorn-tree; Doorn-boom; um-Nga; Monalawna; Mawsu. 2, 3 C. High Veld; Pretoria; Potchefstroom; Waterberg, Zoutpansberg, along the Sand River and east of the Drakensberg.
117. melanoxylon, R. Br.; Australian Blackwood. 6. An "escape," Piet Retief; near Spitzkop, Lydenburg, etc.
118. nigrescens pallens, Benth.; Knopjies-doorn. 3 C; 4. Waterberg; Zoutpansberg, Lydenburg, Barberton Districts and Swaziland.
119. robusta, Burch.; Mokwi; Mokala-mokwi. 3 W. Magaliesberg, Waterberg, Klerksdorp, near Leydsdorp.
120. spirocarpa, Hochst.; Umbrella thorn, Bastard Kameel-doorn. 3 C; 4. Springbok Flats; Rustenburg; Loeuw's Creek, Barberton.
121. stolonifera, Burch. 3 W. Wolmaransstad; near Klerksdorp; near Mafeking.
122. uncinata, Engl. 5. "Transvaal."
123. (verugera, Schweinf.?); "Fever-tree." 4. Komatie-poort.

124. sp. C. Zoutpansberg.
125. sp. D. 4. Near Barberton, 1,000 feet alt.
126. sp. E.; Aapjies-doorn. 3 W. Near Nylstroom; Potgieter.
127. sp. F. 3 W. Blaauwberg; Marico District.
128. sp. G. 3 c. Woodbush Village; near Bremersdorp.
129. sp. H.; Munyaa; Engelsman's doorns. 3c. Near Pietersburg; White River; Bulawayo.
130. sp. I. 3c. Springbok Flats; near Shilouvane.
131. sp. K. 3c. Potgieter; Bremersdorp; Leydsdorp.
132. sp. L. 2. Between Klerksdorp and Wolmaransstad.
133. sp. M. 4. Komatie River.
134. sp. N.; Molowha. 3 E. Along streams near Tzaneen.

51 (3443) *Albizzia*, Durazzini.

135. versicolor, Welw.; Mufufutu (Angola). 4. Loeuw's Creek, Barberton.
136. sp. (cfr. A. Lebbek, Benth.); "Paper-bark." 3 W. Warm Baths.

52 (3452) *Dichrostachys*, Wight. & Arn.

137. nutans, Benth.; Sikkel-bosch. 3 C. Bush country north of Magaliesberg and east of Drakensberg.

Sub-family 2. Caesalpinioideæ, Fl. Cap. 2:289.

53 (3509) *Afzelia*, Smith.

138. quanzensis, Welw.; South African Mahogany, Red Mahogany, Rhodesian Mahogany, N'Shene (Shangaan), Mapoortza (Sesutu), um-Kamba. 4. Le Bombo Flats; Spelonken; Groot Oliphant's River.

54 (3528) *Bauhinia*, L.

139. (reticulata, D. C.?); Mowataaba or Mow'ghataaba, Mulolo (Angola). 3 E. Common near Tzaneen; Bulawayo.

55 (3474) *Burkea*, Benth.

140. africana, Willd.; "Wild Seringa"; Cabilangan; Monaado (Susutu). 3 W. Magaliesberg; Nylstroom; Potgieter; Warm Baths.

56 (3490) *Copaifera*, L.

141. mopane, Kirk.; Turpentine tree; Ironwood tree; Mopaane; um-Falido?; um-Teate, M'Tuate or Mutuate (Angola). 4 (exact altitude uncertain). Near Louis Moore and Little Free State Mines, Zoutpansberg.

57 (3561) *Peltophorum*, Walp.

142. africanum, Sond.; South African wattle; African Blackwood; Rhodesian Black wattle; um-Seshla, 3 C, 4. Magaliesberg; Waterberg; near Leydsdorp; Loeuw's Creek near Barberton.

58 (3506) *Schotia*, Jacq.

143. transvaalensis, Rolfe; Transvaal Boerboon; Maloope. 3 C. Barberton; Smits Drift, Hænertsburg; Thabina Store.

Sub-family 3. Papilionatæ: Fl. Cap. 2:6.

59 (3834a) *Bolusanthus*, Harms.

144. speciosus (Bolus) Harms.; Elephant's Wood; Van Wyk's Hout; im-Pachlt, Rhodesian Wistaria; um-Horhlo (Swazie); P'fimba-hongonye (Shangaan) 3 C. 4. Near Barberton; Le Bombo Flats; near Tzaneen; Blaauwberg; Southern Rhodesia. Plate cli.

60 (3821) *Dalbergia*, L.f.

145. armata, E. Mey. 5. Near Barberton.

61 (3870) *Erythrina*, L.

146. caffra, Thunb.; Common Kaffirboom; Mobale (Shangaan); Mowaale; Maale, um-Sintzi (Kaffr.). 3 C. Magaliesberg; Barberton.

latissima, E. Mey.=tomentosa, R. Br.

147. tomentosa, R. Br.; Cork-tree (Natal); Broad-leaved Kaffir-boom; um-Kwabakwaba (Zulu); Ekirihiti tree. 3 E. Woodbush Village; Sibthorpes, Lydenburg District; M'babane.

62 (3834) *Lonchocarpus*, H.B. & K.

148. capassa, Rolfe. 5. Near Barberton.

63 (3828) *Pterocarpus*, L.

149. angolensis, D. C.; Bloodwood; Transvaal Kajatenhout; Sealing-wax tree; N'Gillasondo, um-Vâgâz or um-Vangasi (Shangaan); Mutete mun-Haneca, (Huilla), Munaabenaabe. (Modjajies). 3 C. 4. Barberton, Lydenburg and Zoutpansberg Districts and Southern Rhodesia.
150. sericeus, Benth.; (in-Dhlanlovu?). 3 C. Magaliesberg; Barberton.

29 (245) Loganiaceæ Lindl.; D.T.H. 398.

64 (6466) ***Anthocleista***, **Afzelius.**

151. insignis, Galpin. T.A.J., Vol. v., No. 17, Pl. cxxxiv., cxxxv. & cxliv. 3 E. Swaziland; Adamanda Mine, Loeuw's Creek; Tzaneen.

65 (6473) ***Buddleia*** (Houst.) L.

152. auriculata, Benth. 5. Barberton.
153. salviæfolia, Lam.; Sage-wood, Salie-hout, Wit salie, Wood sage; Bog-wood; un-Kaza. 1, 2, 3 C. Along streams of the Houtboschberg and near Barberton; Pretoria; near Nylstroom; Johannesburg.

66 (6471) ***Chilianthus***, **Burch.**

154. dysophyllus, Benth. 5. Barberton.

67 (6469) ***Nuxia***, Comm.

155. congesta, R. Br.; om-Kobess, Muchorowe (Kikuyu); Al-biru (Masai) 2. Barberton; Johannesburg; Magaliesberg.
156. floribunda, Benth.; Transvaal Wilde vlier; Wild Elder; um-Quaqu (Zulu). 1. Forests of the Drakensberg.
157. tomentosa, Sond.; Brittle-wood. 1. Forests of the Drakensberg.

68 (6460) ***Strychnos***, L.

158. pungens, Solereder.; Klopper, Wild Orange. 3 W. Magaliesberg; Waterberg.
159. spinosa, Lam.; Klopper, Wild Orange, Moroode. 3 E. Crocodile-poort.

30 (216) Lythraceæ, Lindl.; D.T.H. 340; Fl. Cap. 2: 514.

69 (?) ***Heteropyxis***, Harv.

160. canescens, Oliv. 3 E. Barberton.
161. natalensis, Harv; Lavandel, Makeepa (Modjajies); Masaapa. 3 C. Barberton; Tzaneen; Warm Baths.

31 (140) Meliaceæ, Vent.; D.T.H. 259; Fl. Cap. 1: 244. Seringa Family.

70 (4193) ***Ekebergia***, Sparrm.

162. capensis, Sparrm.; Esschenhout, Cape Ash; um Gwenyuizinja; Dog plum; m'Nyama. 1. Barberton; Houtboschberg; M'babane.
163. Meyeri, Presl; "Meyer's Esschenhout." 5. Barberton.

71 (4175) ***Melia***, L.

164. *azedarach*, L.; Tame Seringa; Bead tree; Cape lilac. 6. An "escape," Pretoria and elsewhere.

72 (4161) ***Pseudocedrela***, Harms.

165. sp. nov. "Mochushu"; Blaauwberg Kopjies, Zoutpansberg, 4,000 feet. 3 W.

73 (4157) ***Ptæroxylon***, Eckl. & Zey.; Fl. Cap. 1: 242.

166. utile, Eckl. & Zey.; Sneezewood, Nieshout, um Tati (Cape). 1. Belvedere, Pilgrims Rest; Hænertsburg; Modjajies Mt.
b. forma robusta, Szyszyl Houtbosch

74 (4195) ***Trichilia***, R. Br.

alata, N. E. Br.=T. pterophylla, C. D.C. 5.
167. (capitata, Klotsch.?); Bastard Sneezewood. 5.
168. emetica, Vahl.; Bastard Esschenhout, um Kuhlu, Rooi Esschenhout, Marba or Marwa (Modjajies); Maawa. 1; 3 E. Houtboschberg forests; Barberton; Tzaneen.
169. pterophylla, C. D.C. 5. Barberton; Houtboschberg.

32 (167) Melianthaceæ, Endl.; D.T.H. 300; Fl. Cap. 1: 366.

75 (4855) ***Greyia***, Hook. & Harv.; Fl. Cap. 2: 308.

170. Radlkoferi, Szyszyl. 5. Houtbosch.
171. Sutherlandi, Hook. & Harv.; 2. Barberton; near Pilgrim's Rest; near Wakkerstroom.

33 (64) Moraceæ, Lindl.; D.T.H. 120. Mulberry Family.

76 (1961) ***Ficus***, L. Figs.

172. Burkei, Miq.; "Burke's Fig." 5. Barberton.
173. capensis, Thunb.; "Cape fig," Bush-fig; Malabar tree, Mato, Moooo'mo (Modjajies). 3 W. Magaliesberg; Waterberg; Swaziland.
174. cordata, Thunb.; "Wonderboom." T.A.J., Vol. iv., No. 13, Pl. iii., iv. and v. 3 W. Magaliesberg.
175. (natalensis, Hochst.?) Natal fig; Natouw, T'Kaa. 1. Houtboschberg forests.

176. sp. A. 3 E. Nelspruit.
177. sp. B. 3 W. Magaliesberg; Waterberg.
178. (Sonderi, Miq ?) 3 C. Barberton; Nelspruit; Nylstroom; Rhodesia.
179. sp. D. 3 E. Barberton.
180. (lutea, Vahl ?) 3 E. Nelspruit; Sabie Valley; near Pietersburg; Mariannhill, Natal; the Matopos.
181. sp. F. 4. Komatiepoort.

77 (1918) *Maclura*, Nutt.

182. *aurantiaca*, Nutt.; Osage orange. 6. An "escape"; Irene; Frederikstad.

34 (236) Myrsinaceæ, Lindl.; D.T.H. 387; Fl. Cap. 4: Sec. 1, 431.

78 (6283) *Mæsa*, Forsk.

183. rufescens, A. DC. 1. Forests of the Drakensberg.

Myrsine melanophlœos, R. Br. = Rapanea melanophlœos (L.) Mez.

79 (6314) *Rapanea*, Aubl.

184. melanophlœos (L.) Mez.; Zwart-bast boom; Wit Beukenhout; Cape Beech; isi-Quani, isQlati (Kaffr.); isi-Quance we-Klati (Zulu). 1. Forests of the Drakensberg.

35 (222) Myrtaceæ, Pers.; D.T.H. 346; Fl. Cap. 2: 520. Myrtle Family.

Acmena, DC. = Syzygium, Gærtn.

80 (5598) *Eucalyptus, L'Herit.*

185. *globulus*, L'Hérit.; Blue gum. 6. An escape; volunteering from self-sown seed.
186. *viminalis*, Labill.; Manna gum. 6. An escape; volunteering from self-sown seed.

Eugenia cordata = Syzygium cordatum, Hochst.

81 (5583) *Syzygium*, Gærtn.

187. cordatum, Hochst.; Water berry; Water bessie; Water boom; um-Doobani or um-Towni (Natal); um-Swe; Munto (Modjajies); um-Doani and um-Swi (Zulu), Mutwa (Shangaan). 3 E. White River; Barberton; Nelspruit; Tzaneen; Swaziland; Natal.
188. sp. A. = (*Acmena Gerrardi*, Harv.); "Forest Waterwood." 1. Forests of the Drakensberg; Natal.
189. sp. B. "Drakensberg." 1. Sabie-hoek and Pilgrims Rest forests.
190. sp. c. 3 E. Selati mine near Leydsdorp.

36 (182) Ochnaceæ, DC.; D.T.H. 315; Fl. Cap. 1: 448.

82 (5112) *Ochna* (L.) Schreb.

191. arborea, Burch.; Cape Plane; Cape Redwood; Rooi-hout; Roode hout; um-Klezane and um-Telele (Zulu); um-Tensema (Kaffir). 1, 2. Drakensberg Forests; Magaliesberg.
192. atropurpurea, DC.
 b. natalitia (Meisn). Harv. 1, 2. Barberton; Houtboschberg; Magaliesberg.
193. pulchra, Hook. 3 W. Magaliesberg; Pilandsberg; Waterberg; Lake N'Gami.
194. Rehmanni, Szyszyl.; "Rehmann's Plane. 3 W. Magaliesberg.
195. sp. Transvaal Boxwood; Merilill. 1. Houtboschberg and Pilgrim's Rest forests.

37 (72) Olacaceæ, Lindl.; D.T.H. 135; (Olacineæ Fl. Cap. 1: 234).

83 (2136) *Ximenia* (Plum.) L. Sour plum; Zuure pruim.

196. caffra, Sond. Sour plum; Wild plum, ama-Tunduluka.
 b. natalensis, Sond. 3 C. Magaliesberg, Waterberg and Barberton.

38 (243) Oleaceæ, Lindl.; D.T.H. 396; Fl. Cap. 4: Sec. 1 478. Olive Family.

84 (6434) *Olea* (Tourn.) L.

197. laurifolia, Lam.; Black Ironwood; Igqwanxe (Zulu); Zwart Yzerhout; Olaliondoi (Masai); um-Qumu. 1. Drakensberg Forests.
198. verrucosa, Link.; Olievenhout; Muthlari. 2. 3 c. Barberton; Buffels; Dolomite outcrops Ottoshoop.

85 (6422) *Schrebera*, Roxb.

199. alata, Welw. (*S. Saundersiæ*, Harv.). 1. Drakensberg forests.

39 (213) Oliniaceæ, C. Presl.; D.T.H. 337; Fl. Cap. 2: 519.

86 (5428) *Olinia*, Thunb.

200. **cymosa**, Thunb.; Hard pear; Haarde pyr; Red berry; Satyobe (Zulu); 1, 2. Forests of the Drakensberg; Magaliesberg.

40 (118) Pittosporaceæ, Lindl.; D.T.H. 203; Fl. Cap. 1: 443. Pittosporum Family.

87 (3252) *Pittosporum*, Banks.

201. **viridiflorum**, Sims.; Kasuur (Tzaneen); um-Quenque; um-Kwenkwe; 1, 2. Barberton, Pilgrim's Rest, Hænertsburg, Pretoria.

41 (145) Polygalaceæ, Lindl.; D.T.H. 266; (Polygaleæ Fl. Cap. 1: 79). Milkwort Family.

88 (4275) *Securidaca*, L.; Fl. Cap. 2: 585.

202. **longipedunculata** parviflora, Oliv. Buazé. 3 W. Warm Baths.

42 (66) Proteaceæ, J. St. Hil., D.T.H. 125. Sugar-bush Family.

89 (2034) *Faurea*, Harv.; Beukenhouts.

203. **saligna**, Harv.; Transvaal Beukenhout, Zwart Beukenhout, Dwadwa; Mutaago (Modjajies). T.A.J., Vol. III., No. 9, Pl. XI. and XII., and No. 12, Pl. lxxxii. 3 C. Waterberg, Rustenburg, Marico, Pretoria and Zoutpansberg Districts.

204. **speciosa**, Welw.; Broad-leaved Beukenhout. 3 E. Lower slopes of the Drakensberg.

205. **sp.** Red or Rooi Beukenhout. 1. Borders of forests at Pilgrim's Rest and Barberton, 5,500 to 4,500 feet.

90 (2036) *Leucospermum*, R. Br.

206. **Zeyheri**, Meisn. 5. "Swaziland."

91 (2035) *Protea*, L.; Sugar-bush; Wagenboom; Zuikerbosch.

207. **curvata**, N.E. Br. 2. Barberton.

208. **hirta**, Klotzsch. 2. Johannesburg.

209. **(lanceolata**, E. Mey?). 5. Barberton.

210. **Rouppelliæ**, Meisn. Common Sugar-bush. 2, 3 C. Widely distributed; Pretoria, etc.

43 (169) Rhamnaceæ, Lindl.; D.T.H. 301; (Rhamneæ Fl. Cap. 1: 475).

92 (4875) ***Rhamnus*** (Tourn.) L.

211. **prinoides**, L'Hérit. 1, 2. Borders of forest, Drakensberg; Pretoria; near Ottoshoop.

212. **Zeyheri**, Sond.; "Red Ivory"; Pink Ivory 3 C. Magaliesberg; Waterberg; Barberton.

93 (4861) ***Zizyphus*** (Tourn.) L.

213. **mucronata**, Willd.; um-Pafa (Kaffr.); Omkebeza (Cape); Buffelsdoorn; Kat-doorn; Bog-wood; Buffalo-thorn; Cat-thorn; Blink-blaad wacht-'n-bietje; Mukaala (Modjajies); Haak-doorn; Magalie. 2, 3 C, 4. Donker's hoek; Houtbosch; Warm Baths; Barberton; Komatie poort.

b. **glabrata**, Willd. 3 C, 4. Magaliesberg; Komatie poort; near Leydsdorp.

c. **pubescens**, Sond. 3 W. Pretoria.

d. **var. nov.** 3 E, 4. Komatie poort; near Sibthorpe's.

44 (126) Rosaceæ, B. Juss.; D.T.H. 206; Fl. Cap. 2: 285. Rose Family.

94 (3379) *Leucosidea*, Eckl. & Zeyh.

214. **sericea**, E. & Z.; Oude-hout; Mosine. 2. Western slopes of Drakensberg and Steenkampsberg.

95 (3405) *Parinarium*, Aubl. "Grys-appel."

215. **mobola**, Oliv.; Mobola plum; Hissing tree; Grys apfel-boom; Nocha, Noscha or Noxa. 3 E. Zoutpansberg, Lydenburg and Barberton Districts, below 3,600 feet.

96 (3396) *Prunus* (Tourn) L.
216. *persica*, Gmel.; Peach, Perske. 6. An "escape," Pretoria and elsewhere.
97 (3393) *Pygeum*. Gaertn.
217. africanum, Hook. f; Bitter or Wild Almond; Dumizulu (Zulu); Motore (Modjajies); Nieuw-hout (Knysna); Moeri (Kikiyu); Wilde Amandel; Red Stinkwood. 1. Forests of the Drakensberg.

45 (270) Rubiaceæ, B. Juss.; D.T.H. 489; Fl. Cap. 3: 1. Coffee Family.

98 (8226) *Adina*, Salisb.
218. Galpini, Oliv.; um-Phlume; M'Thlomu; Water matooma; Mohambo (Angola); in-Tchlomu; Transvaal Teak; in-Chongo (Shangaan); Ceylon's Rose. 3 E, 4. Crocodile, Letaba, Thabina and Selati Rivers.
219. microcephala, Hiern.; Pao d'Olea (Angola). 5. Swaziland; Barberton.
Bunburya, Meisn. = Tricalysia, A. Rich.
99 (8281) *Burchellia*, R. Br.
220. capensis, D. C.; "Buffelshoorn"; Buffelsdoorn; Wild pomegranate, Wilde granaten. 1. Barberton; Swaziland.
Canthium, Lam. = Plectronia, L.
100 (8230) *Cephalanthus*, L.
221. natalensis, Oliv.; Quinine-berry; Matawba (Houtboschberg). 1. Forests of the Drakensberg.
101 (8285) *Gardenia*, Ellis.
222. Gerrardiana, Harv. & Sond. 5. Barberton.
223. Neuberia, E. & Z.; Kaffir cherry. 5. Barberton.
224. Rothmannia, L.f.; Zwart-hout; Kalabas; Xelagengane (Zulu) 1. Forests of the Drakensberg.
225. Saundersiae, N. E. Br. 4. Le Bombo Mountain.
226. Thunbergia, L.f.; Buffelsbal; Wilde Katjepiering; Morola Kejortsi, Motletia bolimo. 3. Warm Baths; Barberton.
102 (8402) *Grumilea*, Gærtn.
227. capensis, Sond. "Wood lemon." 1. Forests of the Drakensberg.
Kraussia, Harv. = Tricalysia, A. Rich.
103 (8293) *Oxyanthus*, D. C.
228. Gerrardi, Sond.; Moweelo (Modjajies). 1. Forests of the Drakensberg.
104 (8383) *Pavetta*, L.
229. disarticulata, Galpin. 3 E. Barberton; Swaziland.
105 (8352) *Plectronia*, L. (*Canthium*, Lam. and *Webera*, Cramer).
230. sp. (= *Canthium Gueinzii*, Sond.) Monkey-rope, Baviaans-touw. 1. Forests of the Drakensberg.
231. mundtiana, Pappe.; Rock ash; Klipesse; Kloofhout. 2. Johannesburg.
106 (8308) *Tricalysia*, A. Rich. (*Bunburya*, Meisn. and *Kraussia*, Harv.).
232. Galpinii, Schinz. 5. Barberton.
233. sp. (= *Bunburya capensis*, Meisn.). 5. Barberton.
234. sp. (= *Kraussia lanceolata*, Sond.); Tol-baali. 1. Forests of the Drakensberg.
107 (8351) *Vangueria*, Juss.
235. infausta, Burch. "Misple"; Wild Medlar; Iviyo. T.A.J., Vol. iii., No. 9, Pl. xiv.
3 C, 2. Magaliesberg; Waterberg; Johannesburg.
236. latifolia, Sond. 5. Barberton.
Webera, Cramer = Plectronia, L.

46 (137) Rutaceæ, Juss.; D.T.H. 250; (Aurantiaceæ, Corr. & Xanthoxyleæ, Nees. & Mart.) Fl. Cap. 1: 369, 444 & 445. Orange Family.

108 (4035) *Calodendrum*, Thunb.
237. capensis, Thunb.; Kastanjien; Cape, Kaffir or Wild Chestnut; ol-Larashi (Masai); Mulalachi (Kikuyu); um-Baba. 1. Drakensberg forests.
109 (4091) *Clausena*, Burm. f.
238. inæqualis (Presl.) Oliv.; Bastard Paardepis; Soobapeeri (Modjajies); um-Nukambiba (Kaffr.). 1. Forests of the Drakensberg.
110 (4085) *Teclea*, Delile.
239. natalensis (Sond.) Engl. (*Toddalia natalensis*, Sond.). 1.

240. nobilis, Delile. (*Toddalia nobilis*, Hook. f.). 1. Houtboschberg forests.
111 (4077) *Toddalia*, Juss.
241. lanceolata, DC.; (*Vepris lanceolata*, Juss). White Ironwood; Musungwanesode; um-Zani (Kaffr.); um-Ngumasur (Kaffr.); Siwawaana (Modjajies); Witte Yzerhout, Plate clxxiv 1, 2. Forests of the Drakensberg; Magaliesberg.
natalensis, Sond. = Teclea natalensis (Sond.) Engl.
nobilis, Hook. f. = Teclea nobilis, Delile.
Vepris lanceolata, Juss. = Toddalia lanceolata, DC.
112 (3990) *Xanthoxylum*, L.
242. capense, Harv.; Paardepraam; Knobhout; um-Numgu-ma-bele (Cape); Bobo; Wild Cardamon. 1, 2. Forests of the Drakensberg; Pretoria.
Xanthoxylon, Spreng. = Xanthoxylum, L.
Zanthoxylon, Walt = Xanthoxylum, L.
Zanthoxylum, Fl. Cap. = Xanthoxylum, L.

47 (56) Salicaceæ, Lindl.; D.T.H. 115. Willow Family.

113 (1872) *Populus*, L. Poplars.
243. *alba canescens*, Loud; Abele; White Poplar. 6. An escape from cultivation; Crocodile and Aapjies Rivers, etc.
114 (1873) *Salix* (Tourn.) L. Willows.
244. *babylonica*, L.; Weeping willow. 6. Not known to occur spontaneously; it is doubtful whether seed is produced in the Transvaal.
245. capensis, Thunb.; Cape Willow, Wilde Wilge boom. T.A.J., Vol. iii. No. 9. Pl. xii. 2. Vaal River and upper reaches of the Hennops, Aapjies and Pienaar's Rivers.
246. Wilmsii, Seemen; Wilm's Willow. 2. 3 E. Bröderstroom at Haenertsburg 4,750 feet, Pilgrim's Rest 4,100 feet, Nelspruit 2,350 feet. Eastern slopes of Drakensberg only.

48 (165) Sapindaceæ, Juss.; D.T.H. 294; Fl. Cap. 1: 236. Horse Wood Family.

115 (4734) *Allophylus*, L.
247. sp. (= *Schmidelia melanocarpa*, Arn); Mono-waado; or Moyawaadtu. 1. Zoutpansberg, Lydenburg and Barberton Districts
116 (4836) *Hippobromus*, Eckl. & Zeyh.
alatus = pauciflorus (L.). Radlk.
248. pauciflorus (L) Radlk.; Horsewood; Paardepis. 1.
117 (4784) *Pappea*, Eckl. & Zeyh. Near Lydenburg.
249. capensis, Eckl. & Zeyh. (*Sapindus pappea*, Sond.); Oliepitten; Wilde pruime; t'Kaambesje. 1, 2 Near Lydenburg; Magaliesberg.
Schmidelia melanocarpa Arn. = Allophylus sp.
Sapindus pappea, Sond. = Pappea capensis, Eckl. & Zeyh.

49 (239) Sapotaceæ, Dumort.; D.T.H. 391; Fl. Cap. 4: Sec. 1, 436.

118 (6377) *Chrysophyllum*, L.
250. Wilmsii, Engl. 5. Near Lydenburg.
251. magalis-montanum, Sond.; Stem-vrugte; Ma-kladzu, Muklaadzwa. 3 W; 2. Magaliesberg; Waterberg; Swaziland; Barberton; Johannesburg.
119 (6386) *Mimusops*, L.
252. obovata, Sond. 3 W. Warm Baths.
253. Zeyheri, Sond.; Moople or Moupouloo; Melkhout. 3 W. Magaliesberg.
120 (6368) *Sideroxylon* (Dill.) L.
254. inerme, L. 3 W; 4 (?). Near Pretoria.

50 (257) Scrophulariaceæ, Lindl.; D.T.H. 453; Fl. Cap. 4: Sec. 2, p. 121.

121 (7493) *Halleria*, L.
255. lucida, L.; Wild Fuchsia, Witte olyve, White Olive. 1, 2. Forests of the Drakensberg; Pretoria.

51 (138) Simarubaceæ, Lindl.; D.T.H. 257.

122 (4128) *Kirkia*, Oliver.

256. sp. nov. "Mosaache" (Modjajies). 3 C. Near Barberton; Warm Baths; Potgieter; Buffels.

52 (178) Sterculiaceæ, Schott. & Endl.; D.T.H. 310; Fl. Cap. 1: 178. (Byttneriaceæ R. Br.; Fl. Cap. 1: 179).

123 (5053) *Dombeya*, Cav.

257. rotundifolia, Harv.; Dik-bas; Drall-pyr; Moko-'ba (Sesutu); Mokowlaseeba. 3 C. Magaliesberg. Waterberg, near Lydenburg.
densiflora,-Planch. = rotundifolia, Harv.

124 (5083) *Sterculia*, L.

258. murex, Hemsl. T.A.J., Vol. iv., No. 16, Pl. xcviii. and xcix. 3 E. Adamanda and Sheba Mines near Barberton; Crocodile-poort.
Terebintaceæ, Juss.; Fl. Cap. 1: 502 = Anacardiaceæ.

53 (214) Thymeleaceæ, Reichb.; D.T.H. 337.

125 (5434) *Peddiea*, Harv.

259. africana, Harv.; Sterk-bast. 1. Forests of the Drakensberg.

54 (63) Ulmaceæ, Mirb.; D.T.H. 119. Elm Family.

126 (1898) *Celtis* (Tourn.) L.
Kraussiana, Bernh. = C. rhamnifolia, Presl.

260. rhamnifolia, Presl.; Wit-gat boom; Wit stink-hout; Camdeboo stinkhout; Soft grey stink-wood; um-Vumon (Cape); um-Ounari (Zulu); T.A.J., Vol. iv., No. 16, Pl. cxi. 2. Outcrops of the Dolomite from Pretoria to Ottoshoop.

127 (1902) *Trema*, Lour.

261. bracteolata, Blume.; Mo-woogoo'woogo (Modjajies) 1. Forests of the Drakensberg.

55 (228) Umbelliferæ, Morison; D.T.H. 364; Fl. Cap. 524. Carrot Family.

128 (5992) *Heteromorpha*, Ch. & Schl.

262. arborescens, Ch. & Schl. 5. Along streams near Spitzkop, Lydenburg District.

129 (6116) *Peucedanum* (Tourn.) L.

263. fraxinifolium, Hiern.; Calusange; Mutatawanna (Modjajies). 1, 2. Forests of the Drakensberg; Magaliesberg.

56 (65) Urticaceæ, Endl.; D.T.H. 123. Nettle Family.

130 (1978) *Urera*, Gaudich.

264. tenax, N.E. Br.; Urera fibre; i-Raw. 2. Magaliesberg; Barberton.

Vacciniaceæ, Fl. Cap. 4: Sec. 1, p. 1 = Ericaceæ.

57 (253) Verbenaceæ, Juss.; D.T.H. 429; Fl. Cap. 5: Pt. 1. p. 180. Verbena Family.

131 (7191) *Clerodendron*, L.

265. glabrum. E. Mey.; um-Quaquane; um-Quaqongo. 3 c. Barberton, 2,900 feet; Waterberg.

132 (7186) *Vitex* (Tourn.) L.; Hardekuil?

266. reflexa, Pearson. 3 E. Barberton, 2,800 feet.
267. Rehmannii. Gürke. 3 c. Makapansberg; near the Nyl River.
268. Wilmsii, Gürke. 3 c. Near Lydenburg; Barberton, 2,900 feet.
269. Zeyheri, Sond. 3 W. Magaliesberg.
b. brevipes, Sond. 3 W. Magaliesberg.

Total:—57 Families; 132 Genera; 269 Species.

No. 2.]

THE HOP AND ITS CULTIVATION.

By H. Godfrey Mundy, Asst. for Seed and Plant Experiment.

Several enquiries have been received as to the likelihood of this crop being grown successfully in the Transvaal, and a few notes on its cultivation may be acceptable.

The value of hops imported into the Transvaal between January 1st and July 30th, 1906, was £4,821. It is evident, therefore, that the demand is considerable and, further, this demand is likely to be a growing one as the country becomes more thickly populated.

The Plant.—The hop belongs to the family Cannabaceæ, and is known botanically as *Humulus Lupulus.* It is a coarse, twining, perennial plant indigenous to England and the northern parts of Europe, now very largely cultivated in the south of England, on the Continent, on the Pacific coast of the United States of America and in New Zealand. Under favourable conditions the plants grow from 10 to 20 feet high. The flowers are of two kinds, male and female, each kind on separate plants. The male flower grows in a loose branching axillary panicle, and consists of five oblong sepals surrounding five stamens with weak filaments. The female flowers are collected into green scaly cones. When the fruit forms, the scales grow larger and are covered with aromatic resinous globules containing a substance known as *lupuline.* The ovary changes into a small nut-like object containing a single seed.

The male plant is useless for the hop-grower except for the purpose of impregnating the female plants. Some growers have been of the opinion that male plants are not necessary in a hop garden, but the general opinion is that where they are absent the hops lose quality and flavour, and are longer in maturing.

The quality of the hop depends largely upon the soil, climate and season. The plant is deep-rooting as far as the tap root is concerned, but the feeding roots, of which there is a thick network, remain near the surface. The value of the crop depends very largely upon the conditions under which it is grown and the skill with which it is afterwards handled.

The part which the hop plays in the process of brewing is that of imparting flavour to the beer. The aroma of the hop is easily lost by loose packing, bad curing, or long keeping, and for brewing certain of the best quality beers new hops are essential.

Varieties.—Several varieties of hops are grown, each of which has some particular characteristic, such as hardiness, earliness or productiveness.

The chief varieties are Goldings, Farnhams, Colegates, Canterbury Whitebines and Fuggles ; of these the Colegates are rank and bitter and not greatly esteemed by brewers for good quality beer. Goldings, Farnhams and Canterbury Whitebines are the deepest rooting varieties.

Propagation.—The plants are very hardy and can be readily propagated from seed or "*sets;*" the latter are the means by which new gardens are laid down. In cases where seed is sown probably 50% turn out male plants, and of the female plants fully half would be worthless. Raising from seed is only resorted to for introducing new varieties, and is therefore mostly undertaken by specialists. The plant is a very gross feeder ; this causes the crop to be an exhaustive one, and it is usually only grown on the most fertile soils, where in addition large quantities of highly nitrogenous manures can be applied.

Soil.—The most suitable soil is a strong, well-drained clay or stiff loam which is naturally fertile, and the crop is unlikely to do well on soil differing greatly from this. A suitable soil should contain lime and be well-drained, though at the same time having a considerable tenacity for water.

Alluvial deposits are particularly suitable, and it is upon such soils as these that most of the Californian gardens are situated.

An average crop is said to remove over 100 lbs. of nitrogen per acre from the soil ; of this about 56% is in the "hops" and the balance is in the leaves and bines. This shews the exhaustive character of the crop.

Preparing a Hop-garden.—The soil should be deeply ploughed and well cleaned of all weeds, and a good tilth of free working soil maintained on the surface.

The "sets" or cuttings are planted in squares about six or seven feet apart, 2—3 sets per hill. If the hills are 6 feet apart each way there will be 1,210 hills to an acre, while if they are 7 feet apart there will be 889. The "sets" may be planted out in the hills at once or they may be planted in a nursery and then transplanted to the garden when well established.

Male plants should be placed at the rate of one to every 200 hills or six hills of male plants to every acre. These male plants should always be marked so that future "sets" may be saved and not used indiscriminately.

Frequent cultivation is necessary between the rows throughout the period that the crop is growing ; weeds must be kept down as far as possible.

One or two poles are put to each hill in order that the plants may be trained up them.

A new garden may be inter-cropped the first year with cabbages, potatoes or other root-crops.

As soon as the crop is ripe, picking must be commenced without delay ; poles may be taken down and when picking is complete the haulm should be stripped from the poles and carted to the kraal for bedding down stock.

After-treatment.—The following operations will follow in order : The ground should be ploughed and cultivated and then the hills must be pruned ; this consists of removing the earth from the hills and cutting off all suckers and offsets (this is how "sets" are obtained)

only about one inch of last year's growth being left. Hills should be left open for a day or two to dry and then re-covered. Poles must be set up again and bines tied to them, three to each pole ; surplus bines should be cut off. The hills should then be earthed up about 18 inches, and from this date onward horse-hoes must be kept going as long as they can pass up and down the rows.

The initial cost of laying down a garden is about £50 per acre. This covers the work of preparing the soil, planting sets, putting up poles, and the cost of necessary buildings for curing, etc.

The cost of labour, manures, etc., up to the time of picking has been reckoned at £25 an acre per annum ; picking at £10 per acre, and further labour on the crop about another £15—£20 per annum, bringing the total yearly outlay up to at least £50 per acre.

The plant suffers from several diseases and insects, notably the wire-worm, hop aphis and hop mould, the latter caused by the fungus *Sphærotheca castagnei*, Lev.

From the foregoing remarks it will be seen that the hop crop is an exceedingly precarious one owing to the many causes which may conduce to lower its market value, and the large amount of money which must necessarily be laid out on it each year. It is always somewhat of a speculation, but as a rule one good year amply repays the losses on several indifferent years.

The yield varies from 6—20 cwt. per acre, and the value from £6—£10 or even more per cwt.

In the Transvaal it is doubtful whether the crop will do well at present owing to the large number of insect pests with which it would have to contend. Hops could hardly be grown successfully as a summer crop from the fact that the heavy rains in January would come just at the time when the plants require warm dry weather to ripen, and mould would probably result. During wet weather the hop-mould is very active and does immense damage to the crop. It would be necessary to arrange to grow the crop so that the ripening period came after the rains and before the autumn frosts set in.

The crop would probably be best suited to the High and Middle Veld, and on the latter might perhaps be grown as a winter crop under irrigation.

The plants are sensitive to cold winds, and a fairly sheltered aspect is desirable, for preference one with a northern aspect in this country.

The Department hopes to obtain sets of different varieties of hops and to carry out some exhaustive trials with them, but it is questionable how they will stand the voyage, and it will probably be found necessary to pack them in Wardian cases.

On the whole it is not advisable for anyone to do more than test this crop on a very small scale at first, and the difficulty of doing this is accentuated by the fact that the "sets" are not regularly listed by seed merchants, and can only be obtained direct from growers.

No. 3.]

WINTER PASTURE PLANTS.

By Joseph Burtt-Davy, F.L.S.,
Government Agrostologist and Botanist.

Though this article is published in the summer, when there is abundant pasturage on the veld and stock farmers are not worrying much about winter feed, it is by no means out of season; for January and February are perhaps the best months in which to lay down pasturage for the winter.

The need for such pastures in the Transvaal was perhaps never before recognised with such force as last winter, when feed was so scarce that many farmers had to kill scores of newly-born lambs to save the ewes, and the number of grown sheep lost mounted up into the thousands. Some farmers were obliged to buy mealies to feed their sheep, a thing perhaps never before known in this country. This additional trouble seemed most inopportune, when farmers were struggling to restore their flocks and herds to the strength of early days.

The causes leading up to it were primarily the phenomenally dry season, light rainfall, late spring rains, absence of the usual autumn showers, and early frosts, followed by late flocks of locusts which ate off much of the winter feed in the Middle Veld.

The experiments carried out by this Department have shown that much can be done to provide against such losses by one or other of the following means:—The cutting and curing of veld hay and mealie forage; the growing of lucerne, teff and other hay crops; the making of silage; the growing of mangels and other root crops, and, last but not least, the laying down of winter pastures.

Practical farmers are beginning to adopt these methods on their own farms with good results. An increasing interest is being taken in our experiments with winter pasture plants, and many farmers visiting Pretoria have gone to Skinner's Court to see them.

A correspondent in the Carolina District writes as follows under date September 29th last:—

"As you are doubtless aware, the great need of the farmer throughout the country is a sufficient supply of green food during the winter months. More especially is this need accentuated on our cold, bleak High Veld districts, and the man who introduces and successfully grows on these exposed parts a pasture plant that will be eaten by stock during the cold weather will confer an incalculable benefit on a large portion of the farming community, and deserves to be raised to the peerage with the necessary monetary appendage.

"I am hoping that this yet may be attained, although when we remember that very few known plants suitable for winter green food will stand 70° Fahr. during the hot part of the day and 24° of frost at night, that is with the thermometer at 8° Fahr.; this has occurred at least once during this last winter, and many time 15° to 20° of

frost have been registered ; add to these a cutting cold wind and it will be apparent that the successful production of a plant suitable for winter green growth as a cattle food is not to my mind very certain.

"I keep cattle, horses and sheep. The losses to me in cattle through want of green food this year have been large and serious ; horses and sheep although not in good condition have got through a most exceptionally trying and anxious winter.

"The only alternative to growing winter grasses or plants is the erection of extended shedding or stabling, and a large silo or silos capable of holding 600 tons or more, but as these would involve an expenditure beyond my means, I would fain rely upon the growing of plants which would give succulent winter grazing instead."

After referring to the descriptive list of pasture plants in Bulletin I. of this Division, he adds :—

"The following seem to be worth trying on my farm :—Sheep's Burnet, Tall Fescue, Reed Fescue, Meadow Fescue, Rescue grass, New South Wales Blue-grass, Saltbushes—*Atriplex semibaccata* and *A. leptocarpa*. I have also a spot suitable for *A. nummularia* which might be suitable for shelter if for nothing else."

Unfortunately, last season was not favourable for establishing winter pastures ; newly sown grasses do not, of course, stand an exceptional drought as well as those which have been growing longer, and which are therefore deeper-rooted and more fully established. The plots also suffered from the depredations of Cape hares, probably owing to the unusual scarcity of wild feed.

In spite of all these drawbacks, however, the experiments have given most satisfactory results, and we now feel justified in laying down larger areas under winter pasturage. There is much to be learned on the subject before we can confidently advise farmers as to the best mixtures for different soils and different districts, the best method of treatment, the best mixtures to use, and what proportion of each will give the best results in this climate.

The following are among the most satisfactory of the sorts grown at Skinner's Court :—

Sheep's Burnet (*Sanguisorba minor*).—The most drought-resistant of the winter-growing plants tried ; it has given excellent results at Skinner's Court, the Willows, the Springbok Flats, Standerton, Ermelo and Potchefstroom. Good reports have been received from farmers in several district ; it is particularly suited to the High Veld. Burnet is a deep-rooting perennial plant, naturally growing on dry, poor soils ; in the humid climate of Europe, where more valuable pasture plants can be grown to advantage, it is not much appreciated, and is often found as an impurity in seed of sainfoin. On the High Veld it is eaten with relish by sheep and cattle when other green food is scarce ; it not only keeps green but continues to make growth in mid-winter ; it is not liked as well in summer when green grass is plentiful, and stock may require to get somewhat accustomed to it before they take to it readily. It is apt to become woody after flowering, and should therefore be kept well grazed. If sown thickly the plants are apt to crowd

one another and not to thrive so well, and Burnet seems therefore better suited for mixed pastures than for pure sowings.

Australian or New South Wales Blue-Grass (*Andropogon sericeus*).—A tufted bunch-grass, standing heat, drought and frost remarkably ; a strongly growing species when once established, which should be grazed closely so that it may not become woody. It continues to be one of the best winter grasses at Skinner's Court, and has done well at the Willows ; it is eaten readily by stock.

The excellent winter growth made by this grass has brought in many applications for seed. Unfortunately we have been able to secure only about fifteen pounds from Australia, after applying to all the seedsmen and to various agricultural experiment stations, and for that had to pay 5s. per lb. A correspondent in Queensland writes :—

"I fear it will be a difficult matter to procure this seed. None of our seedsmen are enterprising enough to stock our native grasses, probably on account of the apathy and indifference of landholders and others who should be interested in their propagation and conservation. Our own supply is limited as we have only a small area of land to devote to indigenous grasses, but I can promise you a small parcel of the seeds you require within a few months' time." We are therefore growing our own seed at Skinner's Court, and hope soon to have enough for general distribution.

Sheep's Parsley or Peterselie (*Petroselinum sativum*).—A deeply-rooting perennial plant, remarkably drought-resistant and particularly liked by sheep at all times ; somewhat sensitive to frost, but at Skinner's Court it kept green all winter, with 11° of frost (in the Stevenson screen). In mixtures with Burnet and the finer grasses, such as meadow-fescue and the rye-grasses, it will probably do still better as it will be partially sheltered from frost. Has also done well at the Willows, Standerton and the Springbok Flats.

Alfilerilla (*Erodium cicutarium*).—This little annual plant grows vigorously through the winter and early spring, without water. As the hot weather comes on it ripens and scatters large amounts of seed and then dies off. The seeds remain dormant in the soil through the moist, hot summer, starting growth again in autumn, ready for the next winter. Alfilerilla is greedily eaten by stock ; it is rich in mineral matter and its protein content compares favourably with such leguminose crops as lucerne, while the fibre is less than that of lucerne. It must not be overlooked, however, that the seeds of this plant stick in the wool of merino sheep and the hair of Angora goats and reduce their value to some extent ; in Arizona, where alfilerilla has recently been introduced, this depreciation amounts to 1 to 1½ cents (½d. to ¾d.) per pound ; it is there reduced to a minimum by clipping twice in the year, spring and autumn, the autumn clip containing practically all of the seed ; in the Transvaal the seed would accumulate in the spring wool. In the case of Persian and "bastard" sheep, the alfilerilla seed will not be likely to cause trouble.

Tall Fescue (*Festuca elatior*).—A highly nutritious European winter pasture-grass, unaffected by sunburn or frost ; thrives well in

low-lying, heavy vlei soils, especially where there is a little moisture in the soil in winter. After close grazing with sheep and goats in July this grass continued to grow steadily, without either rain or artificial irrigation.

Reed Fescue (*Festuca elatior arundinacea*).—A coarser grass than tall fescue, but rather more hardy and drought-resistant; very vigorous, growing quickly after grazing, even in mid-winter and also standing the hot summer well. At Skinner's Court it was closely grazed off by sheep and goats, which were penned on the plot in July, and, though eaten well down to the roots, growth continued through July and August without rain or irrigation; by August 31st the new growth was 3 inches long, and some of the plants were in flower. A tufted grass, not covering the ground well at first, but this drawback may be overcome by sowing in mixtures with some spreading plants like perennial rye-grass and yellow trefoil, and then keeping the whole rolled occasionally and well grazed. It is one of the best winter grasses at Skinner's Court and has also done well at Standerton.

Meadow Fescue (*Festuca elatior pratensis*).—A very nourishing European pasture and meadow grass, thriving best in cold, moist and loamy soils rich in humus. Useful for mixing with other winter pasture plants, provided they are not coarse-growing kinds such as paspalum, which might smother the meadow fescue. Has given good winter stands at Skinner's Court, Potchefstroom and Standerton.

Chicory (*Cichorium intybus*) and *Lamb's-Tongue Plantain* (*Plantago lanceolata*) also kept green and gave a certain amount of winter grazing for sheep at Skinner's Court, Standerton and the Springbok Flats. The lamb's-tongue plantain is also reported to have given useful winter grazing at Nelsrust, Natal. But the yield of pasturage from these two plants is so small that they do not seem to be worth growing in places where the other species above named can be grown satisfactorily.

Moreover, both the plantain and the chicory are apt to become weeds; their radical leaves lie flat on the ground and are apt to smother out the finer pasture grasses; in some places large areas of good pasturage have been injured in this way.

Cheap Renewal of Poor or Sour Veld.

A correspondent in the Wakkerstroom District writes: "Would the Government Botanist suggest grasses likely to hold their own on sandy Low Veld soil and on hard red Low Veld soil, the sowing to be done, say, by pounding up ant-heaps and sowing seed thereamong. Some cheaper way of introducing grasses is required than sowing after plough cultivation."

The most likely grasses for renovating Middle Veld and Low Veld soils are: Guinea-grass (*Panicum maximum*), Rhodes-grass (*Chloris gayana*), Bermuda or Regte Kwik-grass (*Cynodon dactylon*), African Red-top (*Tricholœna rosea*), the Saltbushes (*Atriplex* spp.), Sheep's Burnet (*Sanguisorba minor*) and Sulla (*Hedysarum coronarium*).

Yellow trefoil, sainfoin, lucerne, hairy vetch and scarlet vetch are also worth trial.

The method of renovation suggested is not likely to succeed sufficiently well to pay for the labour involved. It has been tried by us repeatedly on High Veld soils without any satisfactory result, and is still less likely to succeed in the Middle and Low Veld, where the native grasses and weeds are so rank and tall and grow with such rapidity as to choke out better and more tender plants before the latter have a chance to establish themselves.

The best and most effective method, and the cheapest in the end, is to plough up a few acres each year, with the later autumn rains, allow the land to fallow in winter, plough under one or two crops of weeds in summer and sow down with a mixture of some of the above-mentioned grasses in January or February.

Veld Renovation at Skinner's Court.

Frequent enquiry has been made as to the possibility of improving poor and sour veld by sowing seeds of good grasses in the bare spaces between the tufts of "Sour" grass. Experience in the arid Western States of America has not proved favourable towards this method of procedure. But in order to put it to the test in this climate we disc-harrowed a piece of sour veld at Skinner's Court during showery weather and sowed it down with a heavy mixture of the best grasses for the purpose, to which was added lucerne and yellow trefoil; the surface was then lightly harrowed, and, when dry enough, rolled with the Cambridge roller. Much of the seed germinated and came through, but quickly withered away, "having no depth of root"; we have been unable to find a single survivor, whereas the same sorts of grasses sown on properly prepared land made good stands.

It is unreasonable to expect seedlings to establish themselves on soils such as we find on much of the Transvaal veld, packed to the hardness of stone by the travel during centuries of immense herds of buck, flattened by terrific downpours of hail and rain, and baked by a scorching sun and the still more severe veld fires. Would any farmer of wide South African experience ever dream of sowing his mealies, or even his manna, on the unbroken veld? He would laugh in scorn at the very suggestion, nor can we with any more reason expect the fine and delicate seeds of a pasture grass to survive conditions that would be fatal to the much hardier seeds of the mealie or manna plant.

The only sound way to renovate poor and sour veld is to break up the land, prepare a good seed bed, and lay it down with as great care as one would use for lucerne or mangels. It is sometimes argued that this is expensive; but the result is well worth the cost, and if the cost of laying down 50 acres of pasture properly is too great to be undertaken one year, it would be better to do only five acres each year, or even but one, and do it properly, than to waste seed on an unprepared or poorly prepared seed-bed.

If every farmer put down only five acres each year he would, in a few years, have a good area of pasture for his stock.

Dry-Land Lucerne for Veld Renovation.

A correspondent who farms near Devon Station, on the Springs-Eastward line, writes under date November 5th, 1906 :—

"As promised, I am reporting to you how the lucerne fared that I sowed last December on dry lands. I am sending you a sample plant under separate cover. As I said the seed was sown on dry land and had no other water than rain ; so far I am well satisfied with the result. I have only a few plants ; in fact I am to-day turning over the land again to prepare it for lucerne in January.

"I may state that in part the crop was a failure through my fault ; I ascribe it to inexperience for the reason that I planted the seed too deep. The other causes are : (1) insufficient rain, as you know last season was the worst known season in the Transvaal, and (2) I may say that since March I had sheep feeding on this patch, and they were off and on until September ; I do not wish you to think that there was any feed for there was none, but what I want to say is that it had very bad treatment on purpose to see if the lucerne would again sprout in September. In September there was no sign of it, and I tried hard to find a few plants but could not ; after our October rains it showed not many plants, but a good few, of which I am sending you a sample.

"I am quite pleased with my first trial ; the question always was 'Would lucerne live through the winter in our black turf soil with its big deep cracks in September?' and I may say that if the few plants, which I have now, survived, surely others must also.

"Mr. J. H. King, of Highlands Home, Tarkastad, has some very nice lucerne fields, and he told me to plant broadcast as follows :—

'Plough lands deep, harrow well and sow on a promising day ; get your flock of sheep and run them once over the land.' He tells me that is the way he puts his lucerne in.

"I should be very pleased if you could send me about 40 lbs. of seed, some of the same [*i.e.*, "Provence"] as the 7 lb. parcel was that I got from you last year."

Another correspondent in the Heidelberg District writes under date October 19th, 1906 :—

"It may be interesting to you to know that three years ago I sowed 100 pounds of lucerne on five acres (English) of dry land, soil rather dark sandy. I sowed it in the month of February ; heavy rains followed for some weeks afterwards, therefore it established a stand. The second year it simply got choked with a bushy weed with a blue flower, drought followed until this season ; the weed has died out, and the lucerne has come on again better than ever with this season's rains. A green caterpillar polishes it off for about a month each season, but it grows again when they vanish. This was sown broadcast on new land. It is my opinion that if one can only be fortunate enough in getting continued rains after sowing, it is a success on dry-lands."

Dry-Land Lucerne at the Willows.

Good stands of lucerne have been obtained at the Willows. A specimen secured November 18th from the plot sown down in December, 1904, had a growth of 19 inches, with 160 full-grown shoots and 50 additional young shoots. The stems were fine and the leaves of good texture. The plots have been grazed steadily by the Africander cattle, and both lucerne and cattle are in excellent condition.

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No. 4.]

THE MAKING OF PASTURES.

By G. de S. Baylis, Assistant in Charge of Seed Store.

Success or failure in the laying down of pastures, with or without a nurse crop, depends to a very large extent upon the condition of the seed-bed; it is perhaps permissible, therefore, to describe its treatment from the beginning rather than to start with the assumption that the seed-bed has been prepared.

The first implement to be used is the plough, and the first question to be raised, the depth of ploughing, always, of course, presuming the soil to be a deep one. A well-tilled soil has been shown by experiment to retain the moisture for a longer period than one in the opposite condition, and also to absorb more moisture, both of which are important points in the early stages of pasture formation as they enable the plants to tide over periods of drought, which chance they probably would not have on a more shallow tillage. A fairly compact seed-bed is also a necessity, and without it failure is practically certain; not only must the first few inches be compact, but the whole depth, or else the loose soil by permitting too free circulation of air beneath, causes the soil particles to shrink, ruptures the young roots of the plants, and in consequence the grasses burn or parch out.

Provided that the quantity and quality of the soil is adapted to such tillage, a deep ploughing is preferable to a shallow one, but unless a thorough compacting of the soil throughout its entire depth can be assured, it is often advisable to regulate the depth of tillage according to the chances of compacting the seed-bed. Provided that the whole of the tilled soil is properly compacted, the difference in result between deep tillage and shallow tillage is that the pasture on the deep soil yields more food and is less affected by dry spells than that on the shallow; the latter would yield less, and would be more liable to burn or parch out, especially in the early stages of growth.

After ploughing, and before compacting, it is essential that the whole of the soil should be brought to the finest state of cultivation; this is particularly important in dry climates. The best and cheapest pulveriser at the farmer's disposal is the frost, consequently land intended for pastures should be ploughed early and exposed to its influence. Frost also kills a certain proportion of insect pests. After winter the cultivator and harrows should be put to work, and, if

necessary, another cheap and useful pulverizer, the sod-crusher and leveller, may be used.

This finished, the roller is brought into requisition, so that before the seed is sown the seed-bed may be made compact throughout. Unfortunately few seem to realize the use of the roller; the difference between a well-tilled soil made firm by rolling, and the natural veld which has been parched and battened down by the passage of centuries is that whereas the former is a most suitable seed-bed on which to sow grass-seed, the latter is a certain death-bed on which to waste it. The roller should, however, only be used when the ground is dry; it is then rolled and cross-rolled; after more rain, and when the ground is again dry, it is rolled again until the desired condition of firmness is arrived at.

Such are the principles of preparation of the soil for grass seeds. Economically speaking, the most efficient method of treatment is to take two or three crops off the land before laying it down to grass, ploughing each time deeper and deeper until very deep and most thorough tillage has been obtained. The land, of course, must be kept free from weeds.

Manures.—On the majority of Transvaal soils the use of lime would probably be found beneficial. Lime not only renders the soil less healthy to insect pests which harbour in it, but it also has a mechanical effect upon the soil, rendering it more easy of tillage; it has, likewise, a stimulating effect on the young plants, bringing them more quickly through the rooting stage—the stage at which a young plant ceases to depend upon the parent seed for its nourishment and is thrown upon the resources of its own roots, a most critical period with grasses, clovers, and other shallow-rooted plants; a period which in plant life is equivalent to the "weaning time" in the animal world. Every stockman knows the necessity of good and digestible food at "weaning time." Does every farmer realize the equal necessity of such things at "rooting time"? There is yet another substance necessary to plant life, and one not superabundant in the average veld soil. Humus is the sponge of the soil; it absorbs plant food and stores it up, and also absorbs moisture. A soil wanting in humus is generally a dry soil, and although containing plant food it probably does not contain it in that readily assimilated condition necessary to healthy plants and to young plants in particular.

This brings us back to the crop grown on the land previous to its being laid down in pasture. If manures are too dear in the Transvaal to render their use economically possible, then why not grow the manure needed? Plough in the green crop and the next time you need an overdraft upon the soil's bank of fertility, you will find that you have banked your money wisely. Kaffir beans, soy beans and velvet beans are among the best crops for this purpose.

Grasses may be sown with or without a nurse crop. But few practical men will contend that from the outset a thicker sward is obtained by the use of a nurse crop; yet a nurse crop has its uses, and

there are both times and conditions when without its aid only failure can result.

There are several foreign grasses which if once established will persist and yield green grazing in the winter time, the value of which every Transvaal stock-grower realizes. Farmers are compelled, however, to look at these matters from a commercial standpoint, and are rightly desirous of receiving interest on capital invested; taking into consideration the extreme delicacy of young grasses during the stage of germination and the subsequent period of rooting, they naturally ask themselves the question—How often would the laying down of pastures according to the methods usually prevalent in milder climates be successful in South Africa? It is at this juncture that we turn to nurse crops for a solution of this problem, remembering that nurse crops not only act as a shield from the wind and shade from the sun, but induce a deposit of dew which would not otherwise be obtained. But they are capable of doing still more for us by enabling us to use finer and more delicate grasses in our pastures, the establishing of which would be impossible in the open ground under prevalent conditions.

Presuming the tillage finished, and that it has been decided to use a nurse crop, the seed of the crop selected for a nurse is drilled in suitable distances between the rows, and it may be drilled alone or with some of the more hardy and larger-seeded grasses which do not show the same backwardness in germinating in the open ground, as do many of the finer-seeded and more delicate varieties. After the nurse crop has been drilled in, the roller is put first across the drills once or twice, if necessary, and then with them to finish off. This should thoroughly cover the seed, and also make the seed-bed firm and compact around it. The work is then finished until the rain comes; when the land is again dry the roller is again used to press the rising soil down firmly around the sprouting seeds, and this is done as often as is found necessary. When the young plants are sufficiently advanced to give a certain amount of shelter, and by the action of their roots form the soil into a still firmer yet still a very friable seed-bed, a deep-ridged Cambridge roller is brought into use, and put across the line of the nurse crop. Attached to the roller are seed-hoppers, so arranged that they drop the seeds not anywhere and everywhere, but exactly in the furrow formed by the ridge of the roller. All the fine varieties are sown in this seeding, together with all the coarser grasses, or such varieties as have not been already sown with the nurse, should that practice have been adopted. The smooth roller follows across the furrows, and finally with them, and the work is again completed until after the next rain, when the roller is again used, and so on after every rain, as soon as the land is sufficiently dry and until the young plants are thoroughly established.

In the majority of Transvaal soils, where evaporation is rapid and the contraction of the soil-particles great, should the roller not be used after the rains, the soil forms a surface cake, which lifts bodily, and when the lower layer dries and shrinks leaves the upper surface caked on top and full of cavities below, through which the air circulates,

parching the young roots exposed to its influence and possibly already broken asunder by the rapid shrinking of the soil particles around them. This action of the soil would appear to form one of the most difficult questions to be grappled with in establishing pastures in South Africa, and to a large extent accounts for many failures in germination.

In selecting sites for pasture formation, it would only be reasonable to select the most suitable places. Every seed used has to be procured from foreign countries, having different soils and climates to those found in South Africa, and until it is possible to procure seeds from plants which for a term of years have been acclimatized to the country, every chance should be given to render it both possible for the imported grasses to grow and make permanent stands. Ideal spots for such experiments are often seen upon the foot-hills—a gentle slope lying between the converging of two spurs, a place neither wet nor altogether very dry—in parts perhaps the slight trace of some spring deep down in the ground may be apparent, which spring may probably also be traced in the form of some little spruit, far away in the vlei below. Such spots often possess a good, or at least a fair depth of good red soil, easily and cheaply worked, and not possessing in so marked a degree as the black soil and silty sandy loam, the tendency to crack and parch, or to "lift" after rain.

As nurse crops, teff-grass, rescue-grass, barley, rape, mustard, oats, some varieties of millet, rye-corn and buckwheat could be used. Lucerne sown thinly might also answer the purpose, as well as some of ~~the more~~ hardy grasses from Mexico, California, Arizona and Australia, especially any which germinate freely and admit of being covered with a fair depth of soil. For choice, those showing a fair amount of bunchy, leafy herbage should be selected, annuals being preferred. It is quite possible that among the native plants of the Transvaal an *annual* might be found which, although of not much value in itself, yet possibly might prove invaluable as a nurse. It is not, however, necessary to confine attention to those nurses above enumerated, provided the character of the nurse selected is suited to the necessary treatment. In other countries, celebrated for their pastures, Nature has supplied good nurse crops, but until complete tests have been made with them in this country they need not be named. But these pastures give daily testimony to the value of nurses in the formation and renovation of artificial pastures; although perhaps "familiarity may have bred contempt" and the benefits conferred by these nature-given nurses have not been appreciated at their full value.

The system which has been advanced above is by no means the only system possible, neither are the nurses enumerated the only nurses procurable, or likely to be successful. Methods of cultivation must vary according to the nurses used, the soil to be worked, and the prevailing local conditions, but there is no reason why almost any crop planted in drills, and having the necessary characteristics should not be utilized as a nurse with more or less success.

One thing to be remembered is that a nurse crop *must* be sown thinly, and also that such nurse crop is grown *as a nurse*, and for the

benefit of the young grasses *first* and *foremost*. If these things are considered there is no reason why trials should not be made with Kaffir-corn, mealies, castor oil, cottons, etc., and if successful, the yield from the nurse crop, although thinly sown, would enable the farmer to lay down his pastures both quickly and economically.

Every farmer has had the following experience, and possibly it may be repeated :—The early spring has been a dry one, the mealies already planted have not germinated freely. The crop is a thin one, but half holds possession of the soil. The summer rains have come at last and have fallen both copiously and often. The latent weed seeds lying dormant have sprung to life and seem to revel in the shade and shelter afforded them by their kindly nurse the mealie crop, and the farmer wonders which that land is growing, a crop of weeds or a crop of mealies. It must doubtless also have occurred to him that perhaps Nature was giving him a tip. If so, why not take the tip, and grow not weeds but grasses of our own sowing by a suitable system of cultivation.

Mixtures.—When sowing grasses it is necessary to have some notion as to what we are doing. Approximately in 1 lb. of tall-oat-grass there are 138,000 seeds. In 1 lb. of Milfoil there are 3,510,000 seeds The same number of plants, therefore, are not obtained by sowing an equal weight of seeds. The average number of germinating seeds in 1 lb. varies with different varieties, and the percentage of infant mortality in some grasses is much larger than in others. In other words some grasses are very difficult to bring through the rooting period.

In making a mixture these are all essential points which must be allowed for. The constituents of the pasture must be so regulated that the surface is thickly swarded. The couch grasses must not predominate and take possession. The strong bunch grasses must not be in large enough numbers to kill out those more delicate, in other words, they must not all have the same rooting system and overtax the soil by drawing too heavily upon a certain portion of its depth only. They must not all bloom at the same period ; they must not all die off in the winter, but they must all yield stock-feed. It therefore becomes evident that some practical scale—a system to enable the farmer to know exactly what he is doing when he mixes his seed, is essential for the proper carrying out of pasture experiments in this or any country.

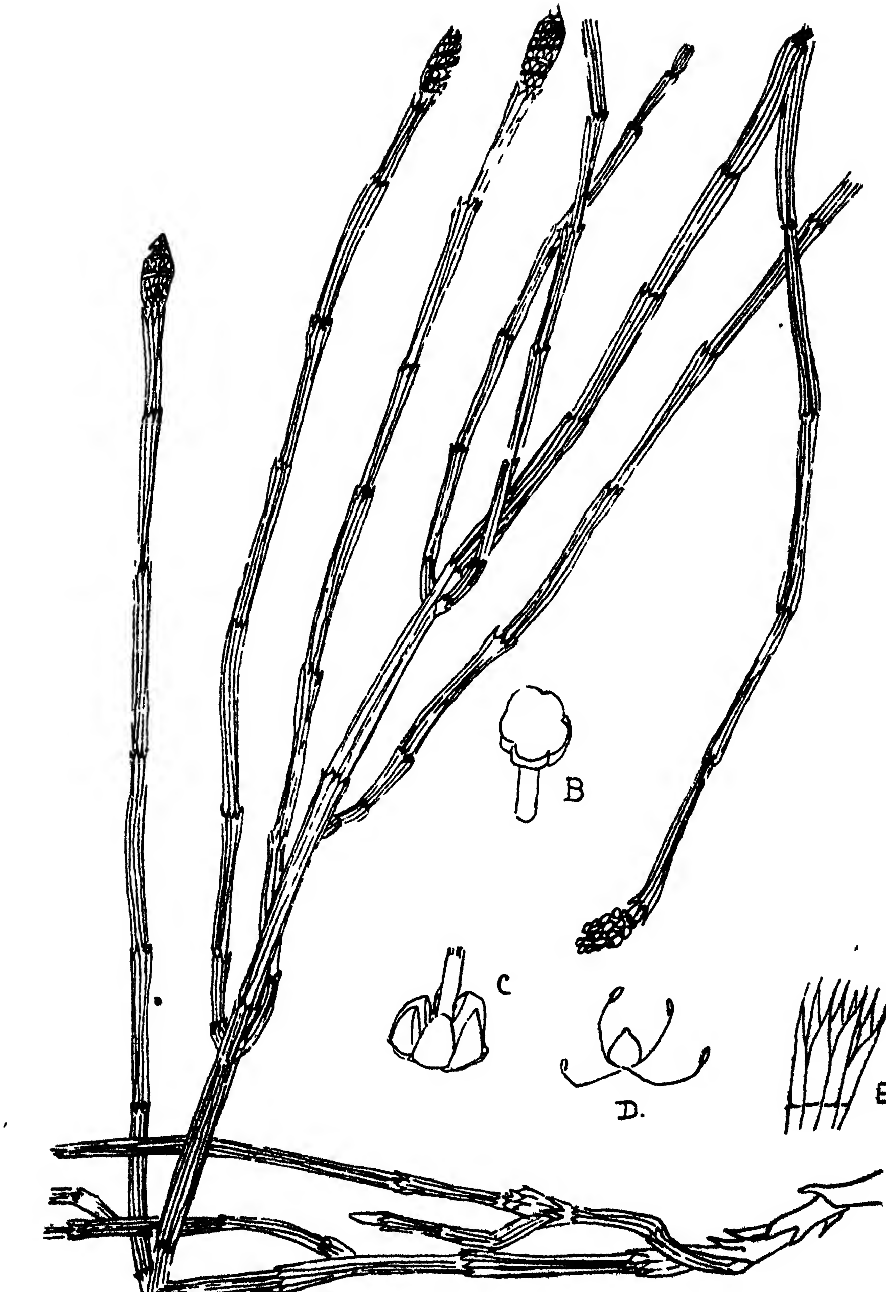
Apart from the mere consideration of grazing, and the introduction of more nutritious grasses than the veld possesses at present, the laying down of land to pasture is the easiest and cheapest means of enriching the soil. The soil becomes enriched not only by the droppings of the increased number of stock grazing upon it, but by the storage of nitrogen in the soil by the roots of clovers and other leguminous plants, and also by the tillage and aeration of its lower levels by the roots of deep-rooting grasses and forage plants which draw both food and moisture to the surface from the lower levels. Humus is constantly being manufactured by the decaying roots and herbage

rich in this substance, and so by laying his land down to pasture the farmer enriches both his land and himself at a minimum outlay. There are yet other considerations worth attention—the laying down of land in artificial pastures, means an increased carrying capacity of stock upon *the same area* ; an increased carrying capacity necessitates, in course of time, other and wider markets. Thus is evolved the dairying industry on the more fertile portions of our pastures ; the dairying industry with all its attendant industries for the utilization of its products, butter and cheese factories, bacon factories and poultry, follow hand in hand on the production and exportation of meat with its freezing works ; and last, yet not least in value, its waste products in the shape of bone, offal and blood-manures. Taking all these points into consideration, it would appear that the formation of artificial pastures in this country is well worth not a few isolated experiments, but efforts which will cease only when their object is accomplished.

It may be that the introduction of certain foreign grasses will solve the question of summer and winter grazing in this country. It may be that we shall solve the question by forming two pastures, one of our best selected native grasses for summer grazing and the other of grasses introduced from foreign countries for winter grazing. This remains to be seen ; few things are impossible, and as both the varieties of grasses to be tried and the methods of possible culture are legion, we cannot pronounce the formation of artificial pastures in South Africa a failure until we have given a fair trial to every one of them.

A Suggestion.—Why should not the farmers assist actively in a quick solution of this problem? Supposing that in every district five farmers having sufficient area, and the necessary implements, were to offer one acre of land each, the seed being supplied them by the Department at actual cost, and such farmers undertaking to sow and cultivate the mixture selected for their district under schemes of experiment which it was thought advisable to test. Strict records could be kept, and at the end of the season a report of the various experiments tried in the various districts, together with the methods pursued, posted to each of the five farmers in the various districts, who had co-operated in these experiments. A nucleus of men interested in this subject would thus be formed in every district, who in addition to such experiment might be induced to grow crops of pure grasses by way of obtaining acclimatised seed which no doubt the Department would be only too glad to buy from them at a fair value. Thus in every district would be found at least five farmers, all as far as these experiments were concerned, working under one chief—not in a haphazard manner, but upon well-defined schemes drawn up to test various species of grasses and various combinations and various methods of culture.

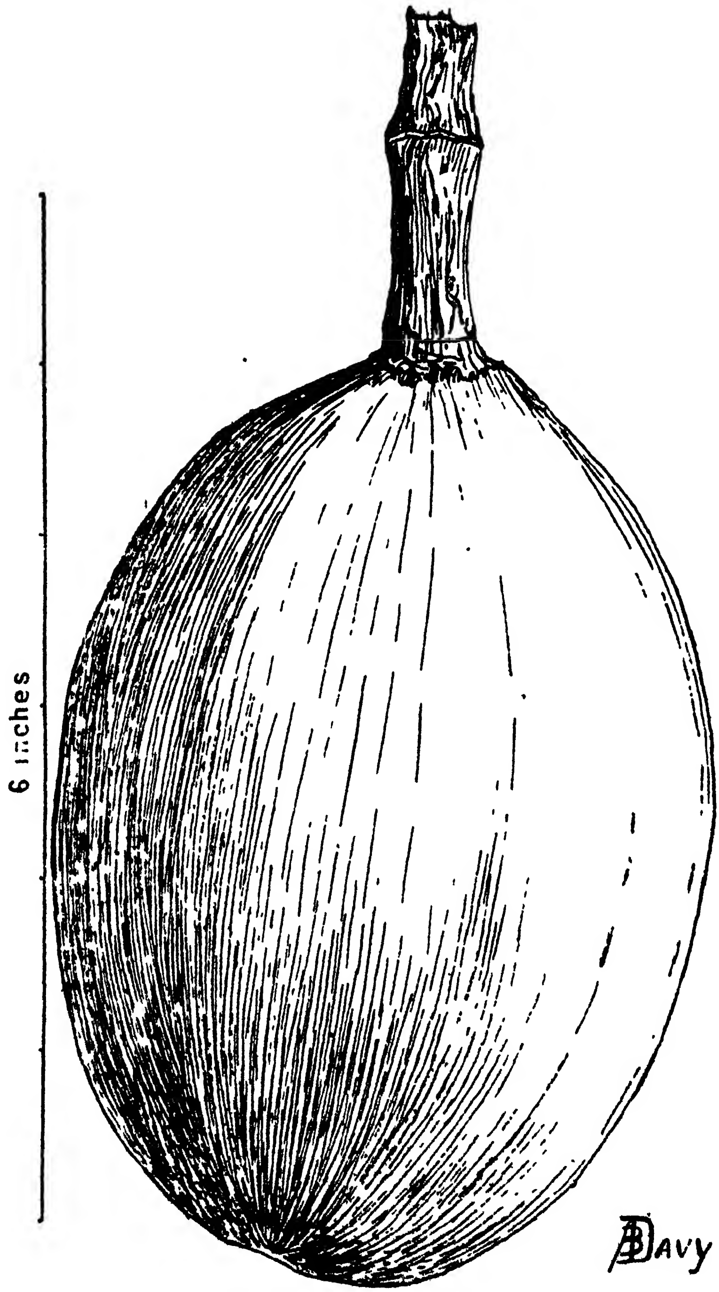
A large field of work lies before South Africa to solve the problem of artificial pastures ; and to finally determine what to sow, and how to sow it. Some may ask, is it worth doing? The answer to this question depends upon the answers to others—Are the dairying and bacon industries worth possessing? Is there any money to be made in the



CLXVIII.

Horse-tail or Dronk-gras, *Equisetum ramosissimum, Desf.* **(After T. R. Sim in "Ferns of South Africa.")**

Supposed to cause Dronk-ziegte in stock.



CLXIX.
Fruit of the Baobab or Cream of Tartar Tree, *Adansonia digitata*, **L. (reduced)**
A Low-Veld Tree.

CLXX. **M'Tadola,** *Cordia abyssinica*, *R.Br.* (Borraginaceæ).

A valuable native timber tree of the Eastern Middle Veld.

growing and exportation of meat? Would our soils be enriched by being laid down in artificial pastures? Do they require manures, and would the bone and blood manures from freezing works established in our midst be of no value to us? Would our farmers and store-keepers be no more prosperous if the establishment of such industries in our midst was rendered possible? Would the land be worth less money? In fine, would not the country be a better one to live in?

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No. 5.]

NOTES FROM SKINNER'S COURT.

Native Grasses.

We now have a considerable number of native grasses under cultivation in order to determine their relative merits as pasture and hay crops. The collection contains but a fraction of the 150 or more wild grasses of the country, but the number of other important experiments on hand has made it impossible to do more in this direction up to the present. It is desirable and important that this collection should be made as complete as possible, for only so can we gain accurate knowledge of the relative value of the different grasses of the veld. It is only by such accurate knowledge of their relative values and relative abundance on different farms, that the grazing value of a farm can be accurately determined.

The best wild grasses at present under cultivation are the following :—

Pasture-grasses.—Buffel-grass (*Panicum hirsutissimum*) ; Bush Buffel (*Setaria sulcata*) ; Sweet Kwik-grass (*Cynodon incompletus*) ; Bermuda Regte Kwik-grass (*Cynodon dactylon*) ; Blaauw-zaad grass (*Eragrostis plana*) ; *Eragrostis curvula* ; *Eragrostis chalcantha*, *Setaria nigri-rostris*, Rooi-grass (*Anthistiria imberbis*), *Phalaris arundinacea*, and African Red-top (*Tricholæna* rosea).

Hay grasses.—Buffel grass (*Panicum hirsutissimum*), Bush Buffel (*Setaria sulcata*); Natal Blue-grass (*Andropogon hirtus*), Sweet grass (*Chloris vitgata* and *Panicum lævifolium*), *Setaria aurea*, *Arundinella Ecklonii* ; Rooi-grass (*Anthistiria imberbis*) and African Red-top (*Tricholæna rosea*).

Plots of 1-20 acre were laid down last year to Natal Red-top, Guinea grass and Bush Buffel-grass. Drought prevented the development of either the Guinea-grass or the Bush buffel-grass, but the African Red-top made an excellent growth, and gave a heavy yield of hay.

Farmers who have seen the plot of African Red-top at Skinner's Court, have expressed doubt as to its being a good grass. This point was tested with a well-fed Jersey cow and calf which were turned into a paddock in which a little of the Red-top had been sown ; although there were plenty of other good grasses there, they took the Red-top first, and ate it down to the ground, although it was in seed at the time. Red-top hay was also eaten readily by horses, mules and cows.

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It is noticeable that the native grasses sown or planted in dry plots, which are, of course, laid out on ploughed ground, start growth very much earlier in spring than do the same grasses on hard, unbroken veld only a few yards distant. A partial explanation probably is that the ploughed land does not dry out as much during the winter as the hard-baked veld, and that it absorbs more of the early spring showers. This is a further argument in favour of laying down winter pastures only on *thoroughly prepared lands*, a method of treatment for which I have consistently contended.

Effect of Clean Cultivation on the Mealie Crop.

To demonstrate the value of cultivating the mealie crop and keeping it free from weeds, an experiment was carefully carried out on a piece of good black vlei land, which was weedy with Sweet-grass, Wild gooseberries, and Mist-breeds. Transvaal Yellow Flint and Hickory King dent were used. The land was treated uniformly before sowing and seed was sown on the same day; no manure was given in either case. No cultivation was done on one half of the plot, which was about 1-8th acre in size (70 × 150 feet); the other half was cultivated and cleaned from weeds three times during the period of growth.

The increase in yield on the cleaned plot was marked; the difference in total weight of stalks as cut, was 75.7%. In weight of cobs it was 57% with the Transvaal Yellow flint, and 70% with Hickory King. The difference in yield between the two varieties was also quite noticeable, in both cases being in favour of the Transvaal Yellow flint, which on uncleaned land gave 3½%, and on cleaned land 10% more by weight than Hickory King.—Joseph Burtt-Davy, Government Agrostologist and Botanist.

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No. 6.]

THE PRICKLY PEAR IN THE TRANSVAAL.

Letters are occasionally received from persons who have lived in Australia and parts of Cape Colony where the prickly pears have become a nuisance, calling attention to their occurrence in the Transvaal and to the trouble they have caused.

This matter has been receiving our careful attention, and for the last four years we have had the prickly pear under observation in different parts of the Transvaal, in order to determine whether or not there is danger of its becoming a nuisance. But because a plant becomes a weed in one country it does not at all follow that it will be troublesome in places where the climate is different; in fact observation shows that in many parts of the world this plant spreads so slowly that there is little if any danger of its becoming a nuisance, and this appears to be the case in most parts of the Transvaal. The principal complaints which have been brought to our notice have had reference to Seccoconie's Country; Mr. Tudor J. Trevor, an old resident of the

Transvaal, who knows that part of the country well, has kindly furnished us with the following information :—

"In our recent conversation regarding prickly pears you asked me to put my reasons in writing for stating that these do not spread in the Transvaal at a sufficient rate to constitute a danger or even a nuisance to the farming interests. My reasons are as follows :—

1. In the years 1888 to 1892 I had occasion to travel all over the Transvaal and adjacent territories.

2. I was must struck by the fact that in Seccoconie's Country and parts of the Zoutpansberg most of the native kraals were defended by hedges of prickly pear.

3. From 1891 to 1897 I lived in Zoutpansberg, and still frequently visit that district.

4. I can see no noticeable increase anywhere in the amount of prickly pears.

5. The only place I know where these have taken hold of a locality is in the kloof at the old stronghold of M'Pathelle, but it must be remembered that these were planted for defensive purposes prior to the Seccoconie war in 1878, nor have they increased much, if at all, since my recollection of the place in 1890.

6. Malieu's Kop, which was heavily defended by these plants at the time of its subjugation in 1868 (?) presents much the same appearance now as it must have done then, while at Mosego and Dsjarte, where in 1878 the Swazies had to throw their shields on the prickly pears in order to storm over them—which by the way they failed several times in doing—they certainly have not increased, though the thorn bush in the meantime has completely swallowed up the whole country.

7. At Isheunis old kraal, behind the store at the poort of that name, there have always been a certain amount of these things, but since 1888, when I first knew the place, they have rather diminished than increased in number.

8. In 1891 I planted prickly pears round some lands on my farm. Some of these have thriven, some have died, but none have spread.

9. The older inhabitants of Seccoconiesland will confirm my statement if asked a direct question ; but if simply asked their opinion of the prickly pear in general, will probably repeat, as others do, some legend that has been circulated of their being most dangerous things, as some district in some other Colony is said to have been swallowed up by them.

10. As a matter of practice I regard these things as a most useful adjunct to a stony wilderness, for be they nutritious or be they not, the fact remains that cattle will eat them and thrive when there is no other food in the country, and in famine times they are the saving of thousands of native lives.

11. It is my firm opinion that if a thornless variety of this shrub could be introduced into the wilderness districts of the Transvaal a great advantage would accrue to the native residents, and, therefore, to the white owners.

12. Into the proper farming country, which is already profitably habitable by white men, I should never propose to introduce the shrub, as doubtless other importations would be more remunerative.

Trusting that the above may put you in the way of getting further evidence on the subject."—TUDOR J. TREVOR, Barberton.

The prickly pear has some value for feeding stock and ostriches in times of drought, and many farmers are in favour of its cultivation for these purposes.

There is strong diversity of opinion on the subject of eradication, and as the spread of the plant in the Transvaal is evidently slow, it would be undesirable to adopt compulsory measures for its eradication until the subject has been more fully discussed.

We already have under cultivation at Skinner's Court what appears to be a spineless prickly pear, but as these things sometimes acquire spines later in life, we cannot yet guarantee our plant.—JOSEPH BURTT-DAVY, Government Agrostologist and Botanist.

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No. 7.]

THE SWORD BEAN.

(*Canavalia ensiformis* (L.) DC. ; *Leguminosæ.*)

Specimens of this bean have been sent by a correspondent at Barberton, with a request for information as to whether it could be used for pig feed or for any other purpose.

This bean is borne on a perennial widely climbing "vine" with trifoliate leaves, the leaflets ovate or oblong, the central one 3 to 6 inches long, the laterals smaller and unequal sided. Flowers are large, pinkish or white and fragrant. Pod scimitar-shaped or curved, 4 to 8 or even 12 inches long, 1 to 1½ inches wide, with prominent ribs on the back, 8 to 12 seeded. The seeds are large, plain red or white or marbled or mottled ; the Barberton specimens are red.

It is a native of the Eastern Himalaya region, and is extensively cultivated in India, Ceylon, Siam, Japan and tropical Africa.

There appear to be several varieties, differing in the colour of the flowers and of the seeds, as well as in the smoothness or hairiness of the leaves.

Linnæus, followed by De Candille, described two of these as distinct species ; the "Sword" or "Jack" bean of the East Indies (*Dolichos ensiformis*, L. ; *Canavalia ensiformis*, D.C.) and the "Overlook" of the West Indies (*Dolichos gladiatus*, L.; *Canavalia gladiata*, D.C.). More recent investigations (*e.g.*, Oliver, in the "Flora of Tropical Africa," and Baker in the "Flora of British India"), write these two under the name *Canavalia ensiformis* (L.) D.C.

The young pods and beans, sliced and boiled, are said to make an excellent vegetable, but little inferior to French beans. They are much grown in gardens in India for this purpose. The nearly ripe beans are boiled and eaten like broad-beans in Demerara, and the fully ripe beans are boiled for a dish called "Mash."

What is considered to be the wild form of this bean (var. virosa (Wight) J. Baker) is apt to develope poisonous properties in the seeds which are bitter, and the seeds of a closely related species, the Bay-bean (*C. obtusifolia*) of tropical Africa, Natal, Australia and tropical America, are said to be decidedly poisonous raw, though eaten by natives when cooked. It is therefore quite likely that the seeds of the sword-bean also might be unwholesome if eaten raw.

There does not appear to be any record of this bean being used for feeding pigs or stock of any kind, but I do not see why it should not be used. It would be desirable to boil the seeds first, both to render them more digestible and to remove any possible trace of poison.—J. BURTT-DAVY, Government Agrostologist and Botanist.

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No. 8.]

THE BAMBARRA GROUND-NUT.

(*Voandzeia subterranea*, Thou. ; *Leguminosæ.*)

The Bambarra ground-nut is a favourite article of food among the natives of the Transvaal and is largely grown near the kraals in the Eastern Middle veld from the Zoutpansberg to Swaziland. In the Zoutpansberg it is called *Dumaraboo* or Dthoomoraba, and the natives of the Pretoria District call it Le-Kloohoo.

It seems to be more largely grown than the pea-nut (*Arachis*), and is said to be preferred to the latter by the natives. The hard beans are boiled in two or three waters before eating, but I have seen natives eat the seeds raw.

The following interesting note by Mr. Burkhill, now reporter on economic products to the Government of India, has been published in a recent issue of the *Kew Bulletin* (No. 4, 1906, pp. 68-70).

"Bambarra, a district on the Upper Niger near Timbuctoo, has in our language given its name to this African ground-nut. Cultivated throughout tropical Africa from the Sahara to Natal, Bambarra has no pre-eminent claim to the plant, which bears a great variety of native names in different parts of the continent. On the Guinea Coast it is aquing or jubbejubbe, in Bornu mgangala, in Angola vielo, in Unyoro mpande, about Kilimanjaro puo, in Nyasaland litlo. On the Mozambique coast, where *Arachis* is called mjugu nyasa, *Voandzeia* is mjugu mawa (mawa—a stone, from the hardness of the seeds, see Grant in *Trans. Linn. Soc.* xxix. p. 8) ; in the Transvaal it is tindhlohu, and in Natal inhlubu.

"There is no trade in Bambarra ground-nuts, save to a small extent at Zanzibar (see K.B., 1892, p. 88), only the hard starchy seeds are eaten wherever grown, the natives supplying their own needs. In German South-West Africa (see Warburg, *Tropenpflanzer* iii. p. 169), and in the region of the great lakes this is particularly the case.

"It is a mistake to count the nut among African oil-seeds, for as

the following analysis by Dr. Thom (*Tropenpflanzer*, 1.c) indicates, the proportion of oil present is insignificant :—

Water	10.20
Oil	4.53
Nitrogenous matter	19.20
Starch	49.91
Phosphoric acid	0.80
Ash	5.13
	89.77

"Dr. Thom does not account for the loss of over 10 per cent., but at the same time he does not give any figure for fibre, cellulose, etc., to which presumably the percentage omitted belongs.

"In a note by Balland (*Comptes rendus* cxxxviii. p. 1061) another analysis is given which corroborates the low percentage of fatty matter obtained by Thom. Balland's results are :—

Water	9.8
Fatty matter	6.0
Nitrogenous matter	18.6
Starch	58.3
Cellulose	4.0
Ash	3.3
	100.0

"Balland's sample of this ground-nut, which came from Bangasso in Upper Ubangi, was exhibited at the Paris Exposition among the products of the French Congo as *Haricot-Pistache*.

"*Voandzeia subterranea*, the only species of the genus, is undoubtedly a native of Africa, despite the statements of Linnaeus and the botanists who preceded him to the effect that it comes from South America. Schweinfurth and Ascherson (*Aufzahlung*, p. 259) record it as wild on the Upper Nile, and it is stated to be both wild and in cultivation in Senegambia (Guillemin, Perrottet and Richard, *Floræ Senegambiæ Tentamen*, p. 254).

"There are several forms in cultivation, differing from one another in the colour and hardness of the seeds. These seeds are about the size of a pea, at times of a pale yellow with a black hilium or point of attachment, at times mottled and ranging through all shades to a very dark brown. Soaked for a night in water and then boiled they are said to form an excellent vegetable. It is further stated (Taubert in Engler *Pflanzenwelt* Ost-Afrikas, B., p. 123) that the red-brown or nearly black seeds become palatable with less cooking than those which are pale in colour or mottled. The younger they are the more pleasant and sweet they taste. They are boiled or fried in butter or oil, or sometimes pounded into a meal. Headaches are said to result from too free a use of them.

"Balland states (*Comptes rendus*, l.c.) that when crushed the seeds of *Voandzeia* yield a white flour with a characteristic odour, but that, when boiled, they have exactly the flavour of chestnuts. He calls attention further to the fact that if we admit the contention of physiologists that the human frame, in order to repair natural loss of tissue, requires daily 120 to 130 grammes of fatty matter and 500 grammes of carbohydrates, we have, even if the co-efficients of digestibility are taken into account, these elements almost exactly present in a kilogramme of Voandzeia seeds. He further remarks that these seeds afford the first instance known to him of a natural substance possessing to an equal degree the chemical features of a complete food.

"There is nothing to record concerning the mode of culture save that Pailleux and Bois (Potager d'un curieux, ed. 2, p. 568) quoting from a correspondent in the Transvaal, recommend that the growing plants be earthed up.

"As the name 'ground-nut' implies, the seeds mature underground. To facilitate the necessary burial of the pod—for none mature that cannot bury (Correa de Mello in *Journ. Linn. Soc.* xi., 254)—the short, somewhat flattened, hairy branches lie prone on the surface of the earth, often penetrating it where soft, and always dipping downwards at the tip. On the primary and a few of the secondary branches are a few leaves, large, erect and trifoliate. The inflorescences, either terminal or from the axils of the leaves, are two-flowered, and invariably penetrate the earth unless prevented by some solid body. The flowers thus produced underground, one on each side of a wart-like termination to the axis—may remain subterranean or may reach the surface by the elongation of the pedicel, and open as small pale yellow pea-like blossoms. In fruiting the ovary is drawn underground. The subterranean flowers, provided like the aerial with pedicels, lie folded on to these, and do not develop any of the conspicuous parts; their petals are absent, and so reduced are the stamens that observers have them female.

"At times all the flowers are aerial, at times all are subterranean; and the earthing-up recommended in the Transvaal has for its object the burying of flowers and fruit.

"The fruit is very like that of *Arachis hypogaea*, but is shorter and usually one-seeded at maturity. Though indehiscent, it is bordered by a prominent sutural ridge such as is not seen in Arachis. The sides are faintly reticulated, and the total length is about ¾ inch.

"Although in many respects very like *Arachis hypogaea*, *Voandzeia* belongs to a different tribe of the Leguminosæ, being much more closely allied to the haricot beans.

"The Bambarra earth-nut long ago found its way into Brazil, where it has passed under the name of Angolan mandubi or earth-nut. India and Malaya have received it, and it is cultivated in gardens to a small extent. It has been tried in North Australia and gave a large yield (Mueller, *Select Plants for Extra-trop. Culture*, p. 576), but nowhere has its cultivation assumed any large proportions."

The following additional note by Dr. M. Greshoff appeared in the No. 5 of the *Kew Bulletin* for the current year :—

"In Western Java the beans are also eaten by the native, and known to them under the name *Katjang bogor* (Buitenzorg Beans) doubtless because the plant was introduced by the Botanic Gardens at Buitenzorg.

"In the Laboratory of the Colonial Museum, at Haarlem (v. Bull. No. 26, 1901), we found this composition for the Java *Voandzeia* :—

Water	12.78
Oil	6.41
Nitrogenous matter	19.12
Starch	49.28
Cellulose	5.79
Ash	3.33
	96.71

"You see that the analysis does not differ very much from the analysis found by Thom and Balland."—J. Burtt-Davy, Government Agrostologist and Botanist.

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No. 9.]

RICE CULTIVATION.

The following note has been prepared in answer to a correspondent at Bronkhorstspruit, who enquires whether the Transvaal is suitable for rice-growing, and the method of treatment.

Rice is mainly an aquatic and sub-tropical crop, but there are some sorts which are grown with less water than others.

Rice is grown for local use by the natives of Mashonaland and by the Shangaans of the North-Eastern Transvaal.

We have grown it experimentally at Skinner's Court, as a lightly irrigated crop, but the High Veld is scarcely suitable owing to the short growing season and the cool nights ; this crop also requires a *humid climate* to give a good yield.

In the rice belt of the Southern United States the best soil for rice is found to be a medium loam containing about 50% clay ; a subsoil of clay is a very important item ; it retains water and permits of quick draining at harvest time, so that machinery can be used for harvesting.

The land is thoroughly ploughed, disked, harrowed and rolled in spring ; shallow ploughing is usual, to avoid turning up the clay subsoil. In some places, as in the Philippines, it is necessary to plough under water as the rice lands lie so low that they are often submerged.

Seed is sown as soon as possible after the spring ploughing ; the earlier the better, when there is no danger from frost, and when there is plenty of water for irrigation.

Seed is sown in drills 12 inches apart, at right angles to the water furrows, and covered lightly ; sometimes it is sown broadcast and the seedlings are afterwards transplanted, but this method is not likely to be satisfactory in this climate. From 1 to 3 bushels of seed is used to an acre.

After sowing, the land is flooded sufficiently to saturate the soil and germinate the seed. In some rice countries the ground is not again irrigated till the plants are about 8 inches high, when it is covered evenly with water to a depth of 3 to 6 inches, and renewed by a continuous inflow and outflow. In South Carolina, the practice is to flood the land when the seed is sown, and let the water remain on till the grain is well sprouted ; the water is then drawn off. When the plants have made two leaves, they are again flooded 10 to 12 inches deep, and gradually reduced to 6 inches, at which point it is allowed to remain 20 to 30 days. The water is then withdrawn and the crop weeded. No water is applied until the plants begin to "joint," when the ground is again flooded until about 8 days before harvest.

Rice is not harvested until the straw begins to turn yellow.

"Mountain" or "Upland" rice requires but little if any flooding in a humid climate, but would require some irrigation here to give good returns.—J. BURTT-DAVY, Government Agrostologist and Botanist.

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No. 10.]

SOME NATIVE FIBRE-PLANTS.

Barbacenia sp. (= *Vellozia retinervis*, Baker).

This plant is the common "Babiaan-stert" of our kopjes ; the natives prepare a string or cord from it, and it has therefore been thought worth while to have it investigated, as of possible commercial value. A specimen was submitted to the Director of the Imperial Institute by Sir Augustine Baker, of Dublin, who collected it in the Western Transvaal while trekking with the British Association from Pretoria to Mafeking.

A technical examination was made by the fibre experts of the Imperial Institute, and the Director has courteously furnished a copy of the report which he made to Sir Augustine Baker, and which reads as follows :—

"The sample consisted of a portion of the stem of a plant, was about 14 inches long, and bore a few, dry, grass-like leaves at the upper end. For about 9 inches of its length the stem was covered with hard, thin, shiny, dark brown scales, beneath which were a large number of light brown aerial rootlets attached to a small central woody cylinder. The lower part of the specimen consisted of rootlets only.

"The coarse rootlets were easily detached from the stem ; they varied in length up to 12 inches, were of a light brown colour, and were covered with a soft, pithy sheath or velamen which, on removal, revealed a group of from four to ten fibres of the same length as the rootlet itself. The diameter of the rootlets was from 1/36 to 1/16 inch,

whilst that of the fibres was from 1/125 to 1/60 inch. The fibres were yellowish brown, slightly wavy, dull and opaque; in some cases they were of fairly good strength, but the greater number were weak and brittle.

"With regard to the utilization of the product, although it may be of some service locally for rough purposes, yet it would not be able to compete successfully in England with the much superior materials usually employed for cordage. Even if the fibre could be obtained of much greater length, it would be unsuitable for the manufacture of rope on account of its deficiency in strength and of the difficulty of freeing the fibres from the sheath by which they are surrounded, an operation which would add considerably to the cost of preparation.

"The plant has been identified at the Royal Gardens, Kew, as *Vellozia retinervis*, Baker, of the natural order Amaryllideae."

Subsequent enquiry was made by this Department as to the possibility of utilizing this material for paper-making. The Director further reports :—

"Experiments which have been made with the small sample of the fibrous stems available here have shown that the material is quite unsuitable for the manufacture of paper pulp. The fibre is extremely hard and does not break up except under very severe treatment."—J. BURTT-DAVY, Government Agrostologist and Botanist.

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HYPOXIS RIGIDULA.

The following is a report by Professor Wyndham R. Dunstan, M.A., F.R.S., Director of the Imperial Institute, on a Transvaal specimen of Hypoxis rigidula submitted for investigation :—

"This sample of the leaves of *Hypoxis rigidula* was forwarded for examination to the Imperial Institute by the Director of Agriculture in the Transvaal, with a letter No. 15056 dated the 15th June, 1906. It was stated that these leaves are used by the natives for plaiting into rope or cord, and it was desired to ascertain whether they could be utilised for any commercial purpose.

Description of Sample.

"The sample weighed about 1¼ lb., and consisted of hard and rather brittle leaves, which measured on an average from 2 feet to 2 feet 6 inches in length and about one-eighth of an inch in width. The colour varied from brown to yellowish-green, but portions of the sample appeared to have become mouldy, probably owing to the leaves having been packed before being thoroughly dry.

Results of Examination.

"A chemical examination was made on selected leaves which did not appear to have suffered in transit. The bases of the leaves, *i.e.*, the portions which had been attached to the bulbs, were cut off and rejected, the remainder of the leaves being alone used for the

examination. The following results were obtained, for comparison with which the figures furnished by a sample of Spanish esparto grass have been added :—

	Hypoxis leaves.	Spanish esparto.
Moisture, per cent (dried at 100 — 11° C.) ..	11.1	13.2
Ash, per cent, on the dry material	4.8	2.5
Cellulose, on the dry material	43.0	54.8
Length of ultimate fibres	0.5 — 5.0mm. mean 2.16mm.	0.5 — 3.5mm. mean 1.5mm.

Conclusions.

"It will be seen from these results that the hypoxis leaves are decidedly inferior to esparto grass, as they contain a higher percentage of ash and less cellulose. They might possibly be used locally for the manufacture of paper pulp, but technical trials would have to be made with larger quantities before any opinion could be formed as to the possibility of such an experiment proving a commercial success.

"Wood pulp, esparto, and other paper-making materials, are at present realising only low prices, Spanish esparto being sold at £4 10s. 0d. to £5 5s. 0d. per ton, and the Tripoli material at £3 to £3 5s. 0d. per ton. These Hypoxis leaves could not, therefore, be profitably exported for use as a paper-making material, and it is difficult to suggest any other purpose for which they could be utilised."

(Signed) WYNDHAM R. DUNSTAN.

30th September, 1906.

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BRACHYSTEGIA BARK-CLOTH.

An enquiry has been received from America about a raw material of commerce obtained from certain trees of tropical Africa.

The information asked for covers the following among other points :—(1) A description of the tree ; where it is grown and any other facts concerning it ; (2) the quantity of bark marketed and the quantity that it is possible to market; (3) the quantity of "bark-cloth" marketed and the quantity that it is possible to market ; (4) the price of the bark and the price of "bark-cloth" at the ports; (5) a list of dealers and exporters of bark or "bark-cloth."

From this enquiry it appears that there is some commercial demand for this product. We have no record of the occurrence of Brachystegia in the Transvaal, but it occurs associated with Transvaal trees in Southern Rhodesia, and it is quite likely to be met with in the Northern Transvaal. If so, it may eventually prove a source of revenue to residents of that part of the country.

The Brachystegias belong to the Family Leguminosæ, Tribe Caesalpinieæ, and in the Flora of Tropical Africa are placed between

the Afzelias and Tamarinds. They are trees, sometimes 50 feet high, with fibrous bark, abruptly pinnate leaves, the leaflets in 3 to 20 pairs, and rather small flowers arranged in terminal simple spicate dense racemes or axillary paniculate confluent glomerules ; bracts caducous ; bracteoles present at flowering, valvate over the bud ; pods leathery or woody, oblong ; seeds few, transverse, compressed.

The following species occur in Tropical Africa :—

1. *B. appendiculata*, Benth. A tree 20 — 40 feet high, found near Lake Shirwa and in the highlands of the Batoka Country ; also near Muata Manja, 14° 19′ South latitude. Near Zomba it is known by the native name of "Chenga," and in Setoka as "Motondo." The seeds are eaten and the fibrous bark is beaten out into a substitute for cloth by the natives of the Batoka Country, in South-Western Rhodesia, near the Victoria Falls.

2. *B. longifolia*, Benth. Occurs in the Shire Highlands, and appears to be used for making bark-cloth ; the wood is described as being very soft ; no further particulars are available.

3. *B. spicæformis*, Benth. A tree 20 — 40 feet or more high, common in rich forests in the Robeho Mountains, Zanzibar, and westward to the Sierra de Hella, Huilla, Angola. It is called M'Chenga or M'Nenga in Zanzibar, and the bark is made into kilts, cloths, band-boxes, huge grain stores, matches, roofing for camp huts, etc.

4. *B. tamarindoides*, Welw. A much-branched tree 15 to 50 feet high, 9 feet in circumference, plentiful in Angola, 30 miles and more inland, at Keegwah, lat. 5° 5′ S. and at 6° S. lat. ; known as "Mecombo." The wood is considered good for building purposes. The bark, after being boiled and prepared, is made into white sheets for cloths worn by the natives. Canoes, boxes, matches and ropes are also made from it. The honey made from the flowers of this tree is considered very superior in flavour and whiteness.

5. *B.* sp. nov. A species apparently undescribed, occurs on the Shire River near Kusuma. The bark of this species also is fibrous and used for cloth.

If any readers of the *Journal* know of the occurrence of these bark-cloth trees in the Transvaal or adjacent territory, we shall be glad to have information about them.—JOSEPH BURTT-DAVY, Government Agrostologist and Botanist.

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No. 11.]

COTTON MACHINERY.

The following useful information is contained in a letter recently received from the Vice-Chairman of the British Cotton Growing Association.

"The best gins for Sea Island cotton are single acting Macarthy gins, and for Egyptian and long stapled American, double acting Macarthy gins. A double acting gin can, however, always be converted into a single acting by removing one of the knives.

"We should certainly not recommend putting down any saw gins unless you are growing the lower types of American Uplands, and we should advise you not to touch this class of cotton if you can grow the better varieties, as the difference in price is very great. You can obtain Macarthy or saw gins either from Messrs. Platt Bros. & Co., Ltd., Oldham; Messrs. Asa Lees & Co., Ltd., Oldham; or Messrs. Dobson & Barlow, Ltd., Kay Street Works, Bolton.

"What we generally do ourselves in the initial stages where only a small quantity of cotton is being grown is to put down a few hand Macarthy gins and a hand baling press made by Messrs. Squire, Ashton & Sons, of Oldham, and which will pack a bale of 200 lbs. The press costs about £25 here, the hand gins cost about £20 each.

"Where, however, power is available, it is better to put down a power Macarthy gin. The production of a single action Macarthy gin may be put at 30 lbs. upwards of clean cotton per hour, and requires one horse power to drive. The double action gin will produce from 40 lbs. upwards of clean cotton per hour, and requires 1¼ h.p. per gin to drive.

"No doubt when there is a sufficient quantity of cotton to justify it, efficient means will have to be taken to press the cotton, but it is not worth while going to the cost of an expensive press unless there are at least 500 bales of 400 lbs. each to deal with annually. The press would probably cost at least £1,000 to put down in South Africa.

"We shall be very glad to endeavour to secure favourable terms for your cotton from Durban or Lourenco Marques, if you would send us full particulars. The quantity of cotton to be expected at the moment is very small, and I should think the steamer people ought to meet us in the matter.

"If you decide to order any machinery we shall be very glad to place our services at your disposal, but we should strongly urge that no great expense be incurred in this direction until it has been ascertained that there is a probability of a considerable amount of cotton being grown in your district."

* * * *

No. 12.]

BOTANICAL NOTES.

Ratooning Cotton.

A correspondent writes: "Can you tell me whether cotton plants can be profitably ratooned, or whether it is better to plough and replant every year?"

It is usually found most profitable to resow cotton from year to year as the staple is apt to deteriorate on ratoons.

With some sorts and in some localities, however, ratooning can be practised, and it is desirable to try sowing a small area of ratoons alongside the re-sown ground, and to submit samples of both products to the British Cotton Growing Association for comparative valuation.

In his report upon Jamaica (Cd. 2684 as cited in the *Journal of the Society of Arts*, October 26th, 1906), Sir Alexander Swettenham

attributes the comparative failure in the cultivation of cotton, in part to the ratooning system. Mr. Oliver, who was deputed by the British Cotton Growing Association to visit the Colony and give advice and assistance to planters wishing to try this crop, strongly opposed the system of ratooning, both on account of the alleged inferiority of the cotton, and the risk of breeding and encouraging insect pests.—J.B.-D.

GRASSES FOR BINDING DAMS.

Several enquiries have recently been received as to the most suitable grasses to plant on dams to prevent cutting and washing. The best grass for the purpose is undoubtedly the Bermuda grass or Regte Kwik gras (*Cynodon dactylon*), but not the common Goet or Quagga-Kwik, which is used so much for lawns.

Bermuda grass is used with good effect on the great levels of the Mississippi River, in the United States, where the strain on the banks in flood time is tremendous.

This grass is spreading extensively in the Transvaal, and usually can be obtained in any quantity desired.—J.B.-D.

ITALIAN WHEATS.

Two samples of wheat have been received from the Government Experiment Farm, Rieti, Italy, through the courtesy of H.B.M. Consul-General, Florence.

It is said that "Both varieties are extremely rust-resistant, and the Director of the Rieti Farm has every confidence in their giving good results even in localities subject to heavy fogs.

"The quantity of seed required is about kilograms 100 per hectare (220 lbs. per 2½ acres), and should be sown rather early.

"The following is the average rainfall in millimetres for a series of years from observation at the Observatories of Aquila and Rome, which cities are both near Rieti where the wheat forwarded to you was grown. The observations at Rome include a period of seventy-three years, at Aquila only twenty-four years."

	Aquila	Rome
	millimetres.	
January	56.3	80.7
February	46.	58.9
March	49.	66.1
April	68.4	65.6
May	57.	54.7
June	39.5	37.1
July	31.5	15.9
August	39.7	27.6
September	49.	71.4
October	76.9	110.3
November	76.2	110.1
December	52.1	87.3
Total for twelvemonth	642.6	785.7

OCTOBER RAINFALL.

The following notes on the October rainfall are taken from the monthly report of the Meteorological Department :—

"It is rather unusual in the Transvaal to have a heavy rainfall during the month of October, but this year a considerable amount has already fallen, although we are only just past the middle of the month. At Joubert Park, Johannesburg, the amount of rainfall recorded between the 1st and 13th of October is 4.43 inches, falling on 8 days. This total has only once been exceeded since the year 1883, when the records were first commenced. In October, 1901, 5.43 inches fell during the month.

"The average rainfall for October is only 2.05 inches so that the rainfall is already 216% of the average, but it still remains to be seen whether a new record is to be established.

"Some large hailstones fell during the storm of yesterday (October 17th). The large ones measured roughly 1in. in diameter and weighed about 93 grains each."

CLIMATIC NOTES FROM SOUTH QUEENSLAND.

A correspondent writes, under date August 17th, 1906 :—

"The past five months have been exceedingly 'droughty' with us. Scarcely two inches of rain since April, but this is not unusual for the winter months here.

"We get our best rainfalls between September and March.

"All the cereal crops throughout Southern Queensland are backward this year, and most of our wheats and barleys are only now being planted. May and June are the usual planting months, but it is remarkable how our crops recuperate after the late spring rains. An instance! Last year the cereals planted in May and June only encountered 1¾ inches of rain at intervals up to the middle of October. At this period the crops had eared at a height of 24 inches. Rain came on the 16th of October, and by the end of November the grain was ripe. Although stooling was thin and the yield curtailed, a splendid quality of grain was harvested, our farm averaging 18 to 20 bushels per acre.

"No manures of any kind are used in Southern Queensland, in fact there is little of our soil which necessitates the application of any fertilizer. Our only need is rain !

"On a farm within a few miles of us wheat has been grown continually in the same paddock for 30 years without the aid of an ounce of artificial manure, and the crops are just as abundant as ever (given rain). The bulk of the Darling Downs country is a characteristic black, heavy soil of volcanic origin, and remarkably rich in plant foods."

WOL KOREN AND KLEIN KOREN IN THE PIET RETIEF DISTRICT.

A correspondent at Piet Retief has kindly furnished the following note :—

"Wol Koren and Klein does equally well here. I am sowing a bag of the former, but the yield does not pay all the trouble spent on it,

generally only 5 to 6 bags for every bag sown, this you will of course understand does not pay. From May 1st to the end of September it has to be watered at the very least once a week. This kind of wheat yields in the O.R.C. 30 to 40 fold, at least so I am told. I want to try and get other kinds that will do at least 12 to 15 bags.

"For Wol Koren I am manuring my land specially thick this season to see if I can possibly better it."

American Cotton Crop.

The U.S. Census Bureau has recently issued its final report on the cotton crop of 1905, which shows a total production of 10,697,013 bales, including 279,836 *round* bales compressed as half bales. Of Sea Islands the production was 112,539 bales. The average prices for the years 1901-1905 were: 9½ cents., 8 cents., 8½ cents., 12 cents., and 9 cents. per pound.—*Journal of the Society of Arts.*

Yields of Lucerne at Skinner's Court.

The half-acre plot of irrigated Provence lucerne at Skinner's Court, cut December 4th, gave 5,439 lbs., equivalent to over 5¼ tons of greenstuff per acre. A twenty-six pound bale, dried into hay, lost all but 7¾ lbs. in drying, on which basis a yield of 10,878 lbs. per acre would give 3,242 lbs. (or 1½ tons) of hay for the single cut. The cuts average one a month during the season.

A $\frac{1}{20}$ acre plot of dry-land lucerne ("Hunter River"), cut December 13th, weighed 550 lbs., equivalent to 6,600 lbs. (or 3¼ tons) of greenstuff per acre. This is equivalent to full 1 ton of hay, as the crops on dry land are less succulent and lose less in drying than the more succulent irrigated lucerne. On dry land the cuts have averaged one every two months during the season.

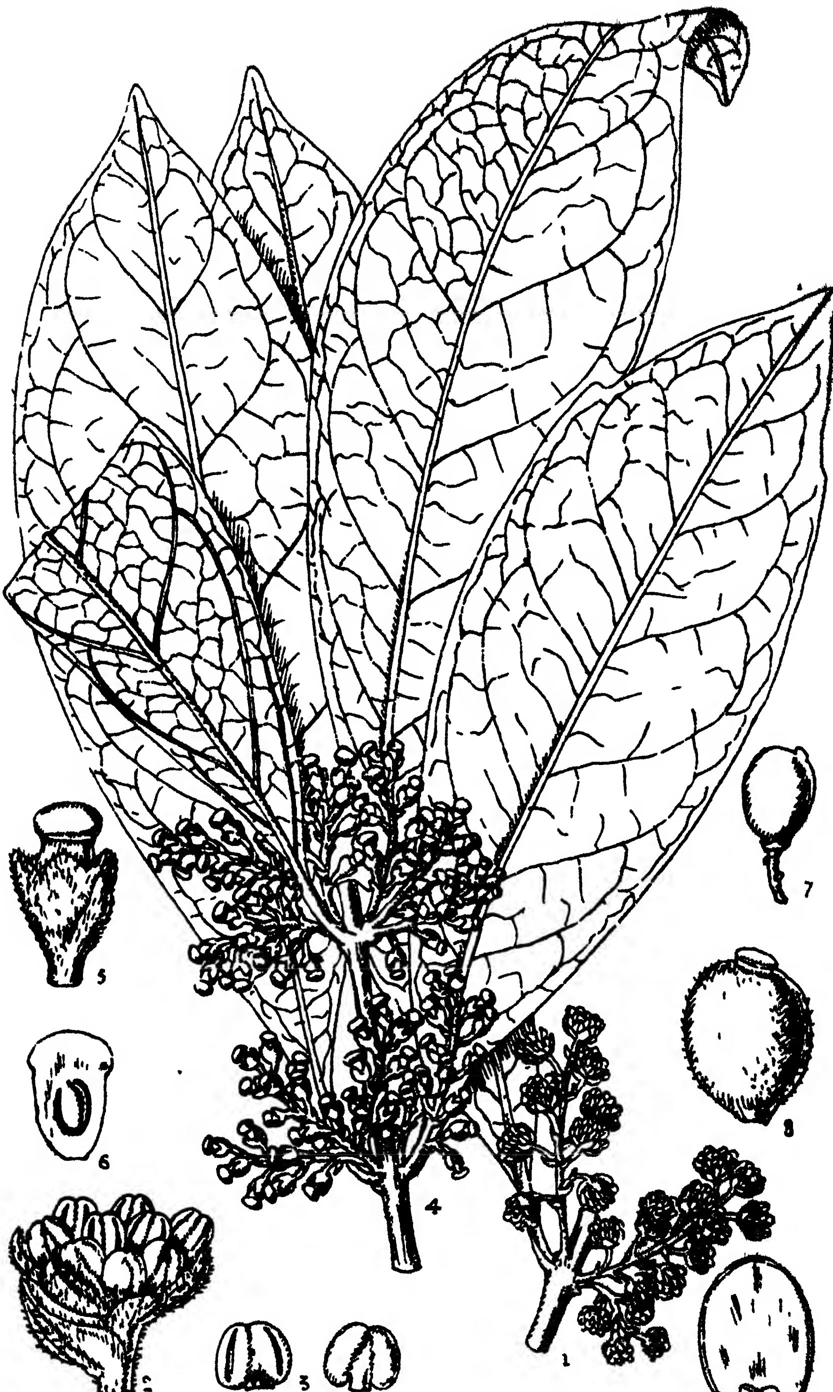
Effect of October Hailstorms and Floods.

A correspondent at Barberton reports, under date October 24th : "The whole of my crops have been destroyed by the hailstorms and floods of this past week. The land is just like bare veld ; the fruit trees are all washed up and the coming crop destroyed, so I shall have to make quite a fresh start. I have lost quite three to four hundred pounds in tomatoes, cucumbers and marrows which I was growing for the Johannesburg market."

Increased Area Under Lucerne.

There is no doubt a "boom" in lucerne cultivation, partly on new land and partly at the expense of other crops. Many farmers are reducing the area under irrigated oat and barley forage, and are putting it under lucerne. A correspondent on the Klip River writes that he now has over one hundred acres of lucerne established, which he is baling and putting into the market.

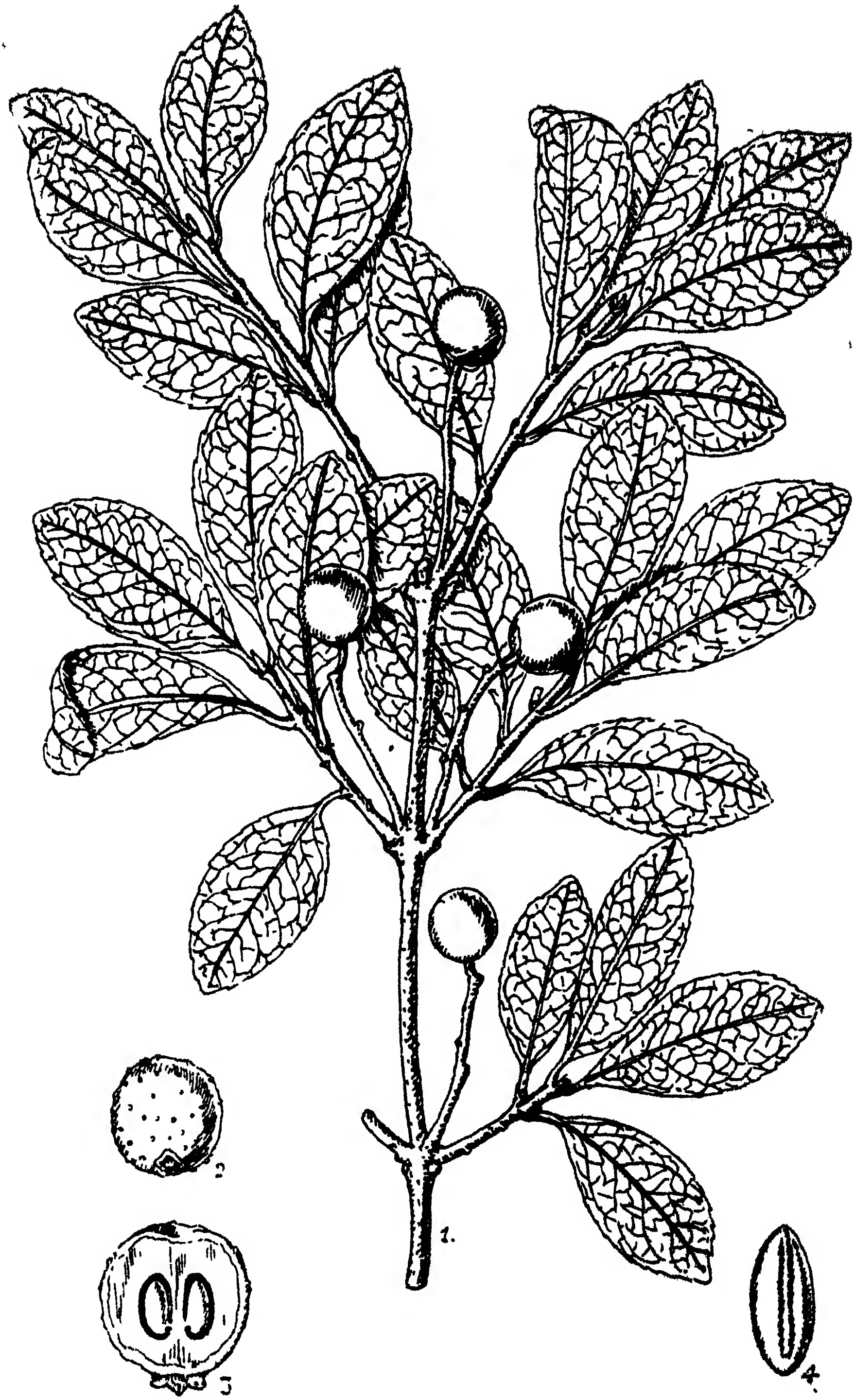
There are dangers ahead of this as of all "booms," one of which is that farmers will be hasty and sow their seed on unsuitable land—too



CLXXI.

Lemonwood or Boree, *Xymalos monospora* **(Harv:) Baill. f. (Flacourtiaceæ).**
A common tree in the Mist-belt Forests.

CLXXII. **Black Stinkwood,** ***Ocotea bullata, E. Mey.*** **(Lauraceæ).**
A valuable timber-tree of the Mist-belt Forests.



M. Smith del.

CLXXIII.

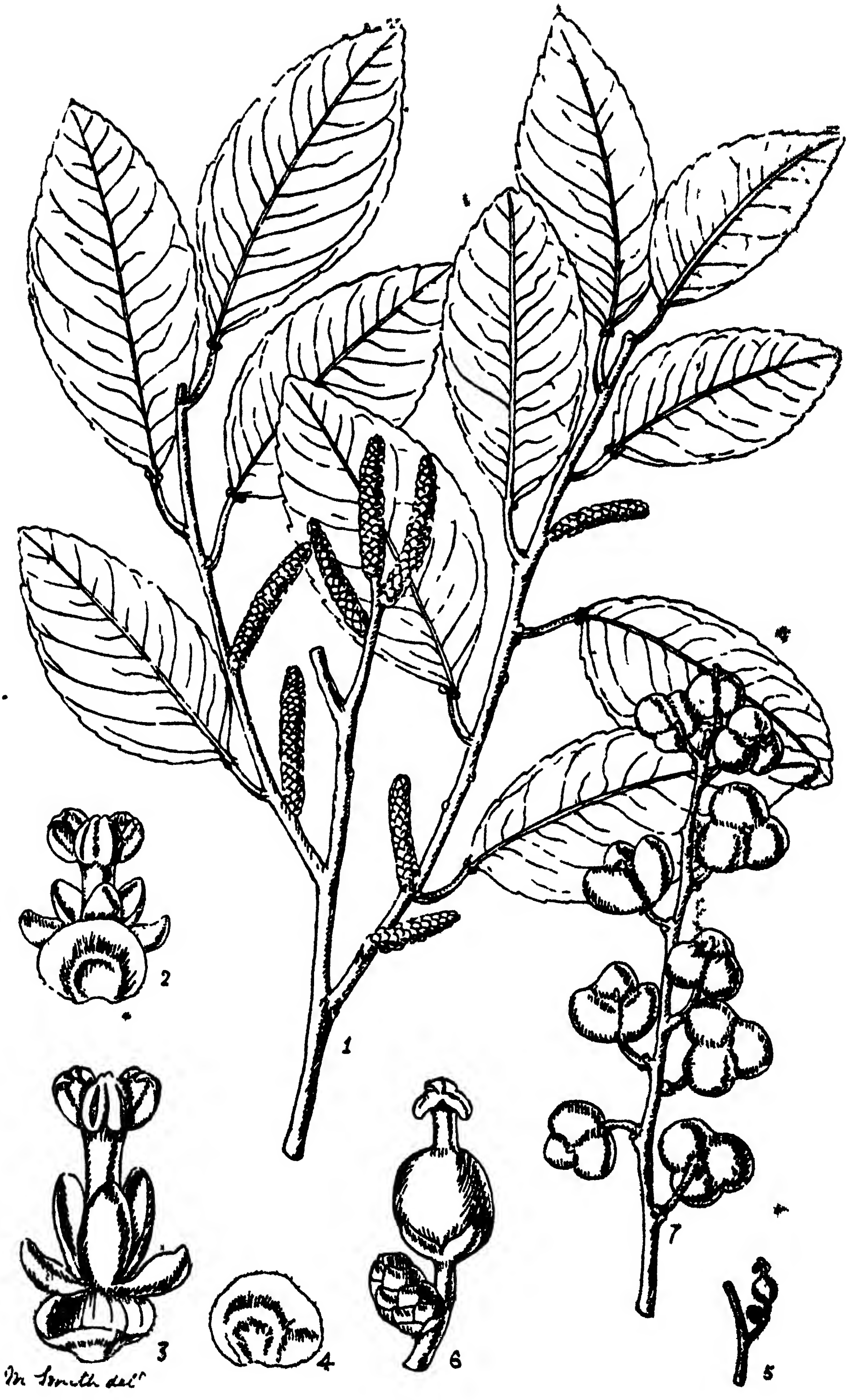
True Saffraan, *Elaeodendron croceum*, *DC.*, (Celastraceæ).

A reserved timber tree.

CLXXIV

White Ironwood, ***Toddalia lanceolata*****, *DC*, (Rutaceæ).**

A tree of the Mist-belt Forests.



CLXXV.

Um-Tambotie, *Excœcaria africana*, Muell. Arg. (*Euphorbiaceæ*)

A valuable timber tree of the Low Veld.

shallow, too wet or too dirty with weeds. Lucerne is a particular crop as to the conditions under which it will or will not grow ; on good lands it is a good crop, but on poor lands it may be a very poor one.

Seed Distribution.

Owing to the increased demands for seed during the current season, our stocks are getting low ; mealies and lucerne are completely exhausted, and we are reluctantly obliged to discontinue issuing for the current fiscal year. Over two tons of lucerne seed has been sent out from the seed store during the season.

We still have a stock of Sheep's Burnet and Rescue grass for winter feed, and as these can safely be sown up till the end of February, we shall be glad to receive further applications.

Injurious Weeds in Cape Lucerne Seed.

A correspondent in the Carolina district has submitted samples of Cape lucerne seed showing a large percentage of sheep sorrel (*Rumex acetosella*). Unfortunately he had sown a good deal of the seed before submitting the samples, and now finds a crop of sorrel coming up with the young lucerne. This weed should be watched for ; it is likely to prove injurious to stock farmers as it spreads among the veld grasses, and is inclined to choke them out, giving little or nothing worth having in their place. A note on this weed, with an illustration, was given in the *Annual Report* for 1903-04, p. 292, Plate xi.

Wild Carrot.

The European wild carrot (*Daucus careta*, L.) has made its appearance in Pretoria, and is likely to become a naturalised weed. We have known it for years as an alien in California, but it never became a serious trouble.

Treatment of Rooi-bloemetjies.

Frequent complaint is made of the damage done by this pretty little weed, and we are often asked to suggest a remedy. This plant is parasitical on the roots of mealies, Kaffir corn, teosinte and other grasses, wild and tame, but as far as I am aware it cannot feed on the roots of plants belonging to other families, such as potatoes, beans, lucerne, etc. One of the best methods of treatment therefore is to grow a catch crop of this kind for one or two years on the infected land, taking care to keep it clean from wild grasses, stray mealies, Kaffir corn, etc., until the weed has been starved out.

Steek-gras v. Locusts.

We are informed that some Cape Colony sheep farmers have been objecting to the destruction of locusts because they claim that these insects are beneficial! The particular benefit claimed in this case is the destruction of steek-gras, which injures the wool of their sheep Enquiry among prominent sheep growers from the districts in question

elicits the information that in spite of locusts, which have been extremely abundant there in recent years, the steek-gras is worse than ever ; when only six inches high it becomes dry, harsh and woody, and when full grown is said to be worthless even to locusts unless there is practically nothing left to eat. In any case, surely steek-gras can be dealt with without having to depend on locusts for its eradication ; and even if nothing can be done with it, it is surely far less injurious to the general farming community than the plague of locusts. Steek-gras is said to flourish most in wet years, and appears to lie dormant in dry seasons.

The Khaki Weed.

It is often stated that the Khaki weed (*Alternanthera echinata*) first appeared in South Africa during or after the late war. Residents of Vryburg state, however, that it has been known there for the last twenty years, at least.

Under date April 14th, 1905, this weed was proclaimed a noxious weed under the Burweed Law, in the Divisions of Kimberley, Vryburg and Mafeking. The Divisional Council of Mafeking has, however, decided to request that that Division be excluded from the terms of the Proclamation. This has now been done by Proclamation of the Governor of Cape Colony under date November 21st, 1906.

The reasons for this action on the part of the Divisional Council of Mafeking have not been stated, but they would be of interest to farmers in the Western Transvaal, in view of their agitation to have this weed proclaimed a noxious weed under the Transvaal Laws

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No. 13.]

NOTES ON THE ILLUSTRATIONS.

Plate CLI. . The Van Wyk's-hout or Maawthlu, *Bolusanthus speciosus* (Bolus) Harms. This is, without doubt, the most ornamental tree of the Transvaal. It attains its finest dimensions in the Low veld, but is also to be found in the Middle veld. The flowers resemble those of the wistaria, but are of a deeper violet colour, and appear before the leaves, in August and September. Well worth cultivation in fruitless regions.

Plate CLXVIII. Horsetail or Dronk-gras, *Equisetum ramosissimum*, Desf. (*Equisetaceæ*) copied from a drawing by T. R. Sim, Esq., F.L.S., Conservator of Forests, Natal, in his "Ferns of South Africa."

A. Fruiting branch natural size.
B. Upper view of receptacle, magnified.
C. Under view of receptacle, magnified.
D. Spore and elaters, magnified.
E. Teeth of stem-sheath.

This plant grows commonly in swampy ground, and is popularly supposed to cause Dronk-ziekte in stock. We shall be glad to have any reports of cases of poisoning by this plant, together with specimens of the plant for identification and experiment.

Plate CLXIX. Fruit of the Baobab or Cream-of-Tartar tree, *Adansonia digitata*, L. (Bombacaceæ) from the northern part of the Zoutpansberg district. The dry matter surrounding the seeds inside this capsule have a pleasantly acid flavour, and are sometimes mixed with water to make a refreshing drink. A photograph of the tree was given in No. 13 of the *Journal*, October, 1905, Vol. iv. Plate vii.).

Plate CLXX. M'Tadola, *Cordia abyssinica*, R. Br. (Boraginaceæ). A native tree on the Tzaneen Estate, Zoutpansberg; yielding a useful timber and handsome when in flower.

The 5 following drawings illustrate some of our more important native trees, and show the flowers, by which they may be identified. These drawings have been prepared from typical specimens in the Kew Herbarium, by Miss M. Smith, the Botanical Artist, through the courteous permission of Dr. Prain, the Director of the Royal Botanic Gardens, Kew.

Plate CLXXI. Lemonwood or Bog-a-Bog, *Xymalos monospora* (Harv.) Baill. f. ; Flacourtiaceæ.

1. Male inflorescence, natural size.
2. Male flowers } enlarged.
3. Anthers. }
4. Female inflorescence and leaves, natural size.
5. Female flowers } enlarged.
6. Section of ditto. }
7. Fruit, natural size.
8. Fruit, enlarged.
9. Section of fruit showing embryo.

Plate CLXXII. Black Stinkwood. *Ocotea bullata*, E. Mey., Lauraceæ.

1. Leaves and inflorescence, natural size. Note the 3 or 4 glands on the midrib of the leaf near the base.
2. Flower.
3. One of the 6 outer stamens } all enlarged.
4. One of the three inner stamens }
5. Staminode.
6. Pistil.

Plate CLXXIII. Saffraan, *Elæodendron croceum*, DC., Celastraceæ.

1. Leaves and fruit, natural size.
2. Fruit } enlarged.
3. Section of fruit. }
4. Seed.

This tree occurs in the Cape forests, but has not yet been reported from the Transvaal ; we shall be glad of specimens from any one who knows of its occurrence.

Plate CLXXIV. White Ironwood, *Toddalia lanceolata,* DC. ; Rutaceæ.

1. Leaves and inflorescence, natural size.
2. Bud enlarged ; note the glandular oil-dots on the sepals.
3. Flower, enlarged.
4. Spray of fruit, natural size.
5. Fruit, enlarged ; note the glandular oil-dots.

Plate CLXXV. um-Tambotie tree, *Excoecaria africana,* Mull. Arg. ; Euphorbiaceæ.

1. Branch bearing leaves and catkin-like male inflorescence, natural size. Note the two glands at base of each leaf.
2. Male flower with bracts } enlarged.
3. One male flower with bracts turned down } enlarged.
4. Bract, enlarged.
5. Female flower, natural size.
6. Female flower, enlarged.
7. Bunch of fruits ; each fruit is a capsule with 3 locules and 3 seeds ; the seeds are often attacked by an insect which lays its eggs inside ; the young grub feeds on the seed and causes it to jump about, producing the well-known "Jumping beans."

THE HORTICULTURAL SECTION.

ON THE KEEPING QUALITIES OF TRANSVAAL ORANGES.

By R. A. Davis, Horticulturist.

It will be within the recollection of our readers that an exhibit of Citrus Fruits grown in the Transvaal was made at the Royal Horticultural Society's Show held in London in June last. The most successful exhibitor was Mr. A. H. Malan, of Hartebeestpoort, Pretoria District. When sending in the samples to this office which did so well, Mr. Malan laid aside one box of oranges which were packed and nailed down in his presence on the 25th May, 1906. This box was forwarded to the Horticulturist, who opened it on the 16th October and found that, without exception, the fruit therein was still in good eatable condition. No special effort was made to store same; the box was kept in the house during the months of June, July, August and September, thus demonstrating what may be done in an ordinary way in the keeping of oranges. Had cold storage been adopted it would have been a matter of no wonder that the fruit had kept so well. As it is, the demonstration appears to be proof conclusive as to the good qualities of our orange crop for storage purposes. Much is, of course, traceable to the perfectly dry atmospheric conditions of our winter months.

It is desirable to take advantage of the foregoing note in order to emphasise the fact that our future export trade in citrus fruits will not depend so much for success upon oranges, etc., being placed on the European markets during the summer months there, as upon our ability to supply the demand which is at its largest during the Christmas holidays. True, a *limited* supply will always sell out of season at good prices, providing the fruit is really of first-class quality, and a market is assured for lemons, *especially* during these very months; but—and this is the important fact—our future over-sea business must consist in putting sweet ripe oranges on those markets during the months when the greatest demand occurs. At present the supply consists mostly of fruit from Spain and the Mediterranean littoral, not thoroughly ripe, and mostly sour and second rate. Such cannot compete with our ripe, perfect product, and it is here that the keeping qualities of our fruit will help materially.

In addition, varieties for present and future planting should be studied and kinds selected which will ripen in October and November, in order that the fullest advantage may be taken both of the European and American markets, as well as our own.

THE CAPE GOOSEBERRY.

(*Physalis peruviana.*)

The Cape Gooseberry, a native of Peru, is amongst the commonest and certainly the most neglected of all our fruit producing plants. I say "our" because it grows over the greater part of this sub-continent under all kinds of conditions and successfully maintains its right to exist under the most adverse circumstances. Very rarely does it receive even ordinarily decent treatment, being often looked upon as a weed and treated as such. There are instances, however, where the cultivation of the fruit as a crop has been undertaken, and the returns have in all cases been highly gratifying. These occur chiefly in the older Colonies, one especial instance being afforded by Mr. Rowland Taylor, of Wellington, C.C., who has cultivated the plant for some years past with much success. The rules for growing are simple in the extreme, and if ordinary care is exercised, the Cape gooseberry can be made a very profitable crop and prove of material assistance to one's income. The principal reason for publishing these remarks now is that the time has arrived when the jam making industry is on the eve of resuscitation in the Transvaal. It is uncertain at present where the first factory will be located, or whether the old Pretoria building will be used, but in any case the carrying qualities of this fruit are such that it is of little moment where the demand arises so long as it is on or near a railroad and within a few days of the supply. It is quite time that such a factory should be opened north of the Vaal River. There is sufficient fruit to keep it well employed, and it could deal with a good deal of fruit which may have been rendered unsaleable on local markets, but which is quite suitable for preserving. No one has ever heard of the supply of Cape gooseberry jam being equal to the demand, but it is of frequent occurrence to enquire for it and be put off with a substitute. It has "caught on" in the English markets, and there is not the slightest doubt but that if a hundred tons were produced next year in the Transvaal that every single berry could be utilised for jam and there would still be a cry for more. The question is whether anyone is willing to consider such a trifle as the growing of a few Cape gooseberries seriously. It is such trivial work to look after a couple of acres of these as compared with a wheat or forage crop—in the eyes of many not worthy of a moment's consideration—yet the two acres of fruit carefully tended should, and doubtless will, bring in £100 per annum. Are there not some amongst our farming community who will take this matter up? The expense attached to it is light, the work easy and the return sure.

Culture.—Although the plant is a perennial, it is best to sow seeds every year and replant with fresh stock annually. Seed should be sown in a seed bed in August or September, and the young plants set out in rows when they are a few inches high. Plant them in rows four feet apart and four feet distant in the rows. This may seem

too much space to allow, really it is barely sufficient. It is a good plan to earth the plants up a little a couple of weeks after planting. The land should be kept clean and free from weeds and cultivated by means of a single horse cultivator once every fourteen days until the growth of the bushes is too great to admit of further work. For small plots a hand cultivating machine may be used with advantage. The main crop should be ripe in December and January. Almost any kind of soil will grow Cape gooseberries, but because it will put up with anything, don't imagine that it will not appreciate really good conditions; the better the soil the bigger the crop and the larger the berries. There are few places in this Colony where the plant will not grow. It thrives best, however, in a climate as near frostless as possible. The only pest which has been known to cause serious damage hitherto is the "Red Spider." This is not as prevalent in the Transvaal as in Cape Colony and Natal, and it should be quite possible to grow a crop without getting any attacks from this insect. If, unfortunately, it should appear its ravages may be kept in check by the free use of sulphur.

Varieties.—There are two other varieties in addition to that spoken of, which have some interest commercially—*Physalis ixocarpa*, also of American origin, and *Physalis francheti*; the latter is now quoted in nursery lists in England and the European Continent. Neither of these has hitherto been tried to any extent in the Transvaal. This year, however, there are a few under observation, and if the results should justify it, seeds of these will be secured for distribution. At present the Department has no seed of either kind on hand.

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NOTE ON THE "KARROO BELLE" GRAPE.

(See Cover Plate.)

This variety of grape, raised originally by Mr. Eagle, of Aberdeen, Cape Colony, is the result of a cross between "White Crystal" and "Muscat Hambro," and has been planted largely in different districts of the Transvaal. The vine arrived with a flattering reputation, but has, unfortunately, proved, in the majority of cases, quite worthless owing to the fact that it bore no fruit. The writer, in the course of his journeyings through the country, has only found two of the kind which ever gave signs of a crop, one of which has been grown by Mr. J. G. Beverley, of Zeerust. It was imported direct from Mr. Eagle on July 16th, 1904, and now is, of course, in its third year. This particular vine has at present 59 bunches of grapes well formed and set, and in perfectly healthy condition. It would appear, therefore, that this grape, one of the few varieties originated in South Africa, will under

certain circumstances do exceedingly well. A description of it furnished by Mr. Eagle has been widely circulated by Messrs. Smith Bros., Uitenhage, Cape Colony. It reads as follows:—

"I have succeeded in rearing a cross between the vines 'White Crystal' and 'Muscat Hambro,' and which I have named 'Karroo Belle.' A magnificent grape, strong grower, enormous cropper, very large and most compact bunches (some cut this season weighed from 5 to 7½ lbs.), round and very large almost stoneless berries, which are a dark brownish purple where well exposed to the sun, but where hanging in the shade are only slightly tinted, or even quite green if very much shaded, and always with a great deal of bloom. Carries exceptionally well, as proved by a box of grapes sent to Johannesburg containing eight varieties, amongst which were 'Hannepoot,' 'Crystal Muscat Hambro,' 'Uitenhage Blue,' etc., all of which were useless except 'Karroo Belle,' bunches of which were perfect. As regards keeping qualities, we cut the first ripe bunch off the parent vine on January 15th, and the last one in June 28th, which were perfectly sound except a few berries stung by the bees through the bag, so that we have been cutting grapes from the one vine for nearly five-and-a-half months."

EXTRACTS FROM EXCHANGES.

POULTRY-KEEPING IN CANADA AND AMERICA.

(*Country Life.*)

Some time ago the Executive Committee of the National Poultry Organisation Society instructed Mr. Edward Brown to make a tour in Canada and the United States for the purpose of examining the conditions under which poultry are raised there, and his report is now before us. Its importance may be inferred from the fact that of the poultry imported into Great Britain during the first seven months of the present year, the value of which was over £500,000, the United States of America sent to the value of £237,900, or slightly over 45 per cent. In quality there has been an advance corresponding to that in quantity, and this has been apparent, in Mr. Brown's opinion, for the last five years. He left Liverpool on June 1st, and visited the chief poultry-rearing States of America, and the packing houses in the great towns. The result is very instructive from an English point of view. In Canada they do things as they are done in Ireland, and take a census of the fowls. From a table showing the value of poultry and eggs produced in the various provinces in 1901 we find that Ontario is easily first in this particular, Quebec following, with the other States a long way behind. The feature of the export trade from Canada is its sudden growth. In poultry it has been increased sevenfold in ten years. No doubt with the extension of farming operations this increase will continue in the future. Already the production of eggs and poultry in Canada is estimated in value at £5,000,000, which is extraordinarily good, if we remember that the population of the Dominion is only about five-and-a-half millions. It may be confidently expected, then, that a large supply of poultry will, in the future, come to Great Britain from the Dominion of Canada.

In the United States the total output can only be estimated, but the Hon. James Wilson, who is the United States Secretary of State for Agriculture, puts the value of eggs and poultry produced in the States in 1905 as being worth more than £100,000,000. The States where most poultry is raised are Illinois, Missouri, Iowa, and Kansas. An expert informed Mr. Brown that in these Western States from 25 to 30 per cent. of the eggs and poultry marketed in America was raised. It is pointed out that wonderful facilities exist for rearing poultry in this part of the world. There is plenty of land to be had cheaply, abundance of food, and a very great demand at good prices. The Americans are famous for doing everything on a large scale, and they have applied their usual methods to poultry. At one farm that Mr. Edward Brown visited there were 5,000 laying hens kept, in addition to the breeding stock. In Philadelphia one man alone has invested £600 in his poultry

plant, and intends to raise it to £20,000. Mr. Brown found that there were very few of those small poultry-keepers that we are so familiar with in England.

He gives a detailed account of Lakewood Poultry Farm, in the township of Bursville, in New Jersey. It was established about seven years ago, and the owner commenced with a capital of two thousand dollars. But the business grew so largely that much more capital had to be put into it. It consists of about sixty acres of sandy soil, on a large fraction of which are the small oak and pine trees characteristic of that section of New Jersey. Upon the farm are several long poultry-houses, divided into eight pens each, giving house-room for sixty birds. In order to keep the ground sweet it is planted with fruit trees, and otherwise cultivated from time to time. In each poultry-house there is a passage-way at the back, and in front of that is a roosting compartment raised above the floor with hinged, curtained fronts, which can be raised in the winter-time ; the rest of the house being employed as a scratching shed, in order to give the birds plenty of exercise. On this farm the favourite birds, and apparently the only ones kept, are White Leghorns, preferred, Mr. Brown says, for the reason that they are active, hardy and excellent layers. They are usually kept for two years, and used for breeding only in the second year. Dependence is placed very largely on the young stock for the production of eggs. At the end of the second season the old birds are sold, and we are told that there is a great demand for them on the part of the Hebrew community. The owner of the farm stated that the success of it was not due to what may be termed the accessories, but to supplying eggs and chickens for ordinary consumption. The eggs are nearly all sold by contract, the lowest price received being 1s. 4d. per dozen delivered in New York. It goes up as far as 2s. 6d. in the winter months. As the reporter remarks, these are high prices, and can only be procured by careful attention to freshness and quality. Another source of income is found in the surplus cockerels. There is a good demand for them as squab broilers when they weigh about three-quarters of a pound.

Mr. Brown gives descriptions of many other poultry farms in the United States, but from the one we have described an opinion may be formed of the others. Speaking generally, the breeds kept are determined by the local taste. In New York white eggs are preferred, and thence White Leghorns, which give a large white egg, are preferred before all others. But in New England housekeepers like a tinted shell, and hence some of the heavier types of birds are selected. A breed that flourishes in Rhode Island and South Massachusetts is the Rhode Island Red, which is practically unknown in England. Elsewhere White Wyandottes, Plymouth Rocks and Light Brahmas are found. The Buff Orpington has been largely introduced into Canada.

Generally speaking, Mr. Brown found the table poultry in the United States inferior to that in Western Europe, a result which he attributes in large measure to the great consumption of broilers. The larger fowls he considered to be about equal in food value to our third and fourth rate poultry ; in fact, inspection of them causes him to

launch forth in praise of the home-grown fowl. The education of the American has not as yet carried him far beyond the taste for broilers, or what used to be called spatchcock in England. That is, after the bird is cleaned and the head, neck and legs cut off, it is split along the back and laid out flat, breast upwards. They cook it by dropping it into boiling fat in Europe, but in America they cook it on a grill in front of the fire. The squab broilers are the same as the petits poussins, or milk chickens of Europe. In addition to the broilers there are the soft roasters, by which is meant large birds, often capons, for which high prices are paid. Mr. Edward Brown gives very detailed particulars of the methods employed by the American poultry-rearers, but the moral seems to be that the facilities for raising poultry there are so great that for some time to come we are likely to receive from the United States huge consignments of poultry, which as yet can only be classified as third-rate, but may greatly improve in the future.

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AUSTRALIA AND HER PASTORAL PROBLEMS.

(*The Scotsman.*)

Australia is admittedly one of the greatest pastoral countries of the known world. By far the largest part of this immense continent is suited to the grazing of sheep and cattle, and our colonial cousins have never failed to make the best possible use of it in that connection. Besides supplying her own vast and growing population with the beef, mutton, and wool which it yearly requires, Australia speeds from her shores each season a veritable fleet of wool-ships to the markets of the outside world, while Australian mutton and Australian butter are favourably known in the cities of Western Europe.

With its warm, growthy climate, temperate winter season, and marvellous recuperative powers, together with its unparalleled supply of nourishing native grasses, it would—but for one or two drawbacks—be a veritable grazier's paradise.

But Australia, like other less favoured lands, has her pastoral problems to deal with, and two, at least, of these are insistent in their demand for immediate attention, if her present success is to continue and her future prosperity to be assured ; these problems are drought and rabbits. Against these two powerful scourges and the intermittent attacks of lesser enemies, such as floods, fires, grasshoppers, and wild dogs, the Australian settler has for long been waging an unequal warfare—unequal, because his weapons have been all inadequate to cope with the well-ordered invasion of these formidable foes.

Upon the sheep farmer of the Great Central West has fallen the heaviest burden of assault. The agriculturist of the more settled portions of the South and East has found the smallness of his holding, and its proximity to the snow-fed and thus more regular rivers, an additional security and bulwark of defence. The cattle-owner of the far-out fenceless regions of Northern and Eastern Queensland has in the more dependable coastal rainfall, and in the very vastness and

variety of his territory, found some safety and immunity. But the squatter of Riverina and the homestead lessee of the Bogan and Lachlan Rivers have toasted too often the anxiety of harassing attack and the bitterness of constant defeat.

As regards drought—the foremost enemy of their most magnificent pastoral country—he has taken toll of its increase for so many years that his aggressive march is a regularly looked-for evil, an inevitable injustice of the stronger against the weaker, which, in spite of all determination in those who struggle so gallantly against it, seems a doom to be suffered from time to time. Against this silent, relentless, and cruel enemy the battle has been long and well-nigh hopeless; the Western men, though grimly fighting still—as they will fight on to the end for their fortunes and their firesides and their families—have acquired in their attitude towards drought something of a pathetic resignation ; riding year after year along their broken battle-line with little or no display of temper, with seldom a fretful complaint, with no worse than a suspicion of sadness in the firm-set, sun-browned faces, they look on grimly while death the destroyer stalks through their barren acres, taking all but the strongest, and marking his way with the bleaching bones of a million dead.

For months at a time the sun shines remorselessly from a sky like beaten copper ; sometimes the clouds come sweeping up at nightfall, flattering only to deceive—for no rain seems able to fall from them. The grass grows brown and dry, shrivels in the furnace breath of the hot winds, and disappears ; the grim, red, tortured earth burns like fired iron through the leather-shod foot of man and the horn-protected hoof of the horse, crumbles into a dusty powder, and is blown aside by every breeze.

The rivers run slower and slower, become a mere chain of stagnant waterholes, and finally dry away altogether, leaving a ghastly fence of prisoned corpses set in the hardened slime. Even the deep pools and artificial tanks give but small resistance to the strangling foe, and their banks resound with the pitiful clamour of the bleating flocks and lowing herds that come to them in vain.

The air is full of the stench of decaying carcases, and vibrates with waves of impending calamity. Wild things of the woods become tame in this common adversity; gaunt emus stalk fearlessly up to the very verandahs of the houses; kangaroos, mere shadows of their usual selves, stand like tawny ghosts on the bank of the fast-drying waterhole ; wild horses, usually too shy to come to water till the dark has fallen and the moon is up, come now in the glare of the red noon, snorting and apprehensive still—bold against their better judgment.

Day after day the flocks grow pitifully less as the grim enemy closes with them, leaving his victims dead on every side.

The settler, powerless to render assistance, rides each morning through the rotting ranks, counting his losses and waiting, waiting for the raising of the siege.

Yet the bushman prepares, to the best of his ability, for these incursions of the drought, whose power and determination he has

learned to appreciate at their true value. He is not without resource. He knows, as well as any fireside theorist can tell him, that water must be conserved to meet these periodical attacks, and that there is no bulwark against the dreaded foe's advance except such as is presented by well-filled tank or well-dammed creek, and this barrier it has been his constant endeavour to supply.

At various points upon the larger rivers may be found huge earthworks of dams, erected at vast expense to ensure at least one permanent and reliable supply of water upon every large holding. Every river-arm has its small dam, every natural hollow is deepened and banked to hold water ; and yet this fierce, relentless enemy overrides and makes useless them all.

If this system is to be Australia's last line-formation against the battalions of drought, then assuredly are her ramparts doomed, for four years of severe drought will find the bottom of the deepest of these Western reservoirs, when—as would be the case—it had become the sole reliance of settler, horse, and herd.

The finding of artesian water came as a blessing to the squatter of these Western plains, at his wits' end for some means of coping with the prolonged periods of dry weather to which he was becoming accustomed but by no means reconciled. The heavy cost, however, of sinking these wells is in many cases prohibitive, and, though the ultimate advantages undoubtedly compensate for the outlay, capital is not always to be found available for the initiation of the work. Artesian water, where it has been found in satisfactory quantities, has turned the semi-arid desert of the Central West into a veritable garden. It is a beautiful sight, when all the surrounding country is a waste of barren sand and driven dust, to see one of these wonderful internal reservoirs of the earth tossing up through a five-inch pipe a great volume of crystal water, at the rate of perhaps a million gallons in twenty-four hours. Night and day this level flow never ceases, and there appears to be so far no sign of exhaustion in the supply of any of the large bores as yet put down, which favours the frequently advanced theory that this water is released from some mighty underground river.

From these facts it might be assumed that the future salvation of the arid tracts of Central Australia will depend upon irrigation. "You have the rivers," says the arm-chair Empire theorist ; "all that you require is to cut channels for the water, and your desert land will blossom into life. Look at the United States—the Central West—Colorado, Nebraska, Utah ! Look what *they* have done! There's energy for you! There's irrigation for you!"

But the Western bushman knows his country better than any stranger can know it, and a grim smile plays about his firm brown mouth. He knows his low-lying rivers and their utter inadaptability to irrigation. He knows them all too well—a chain of muddy water holes in summer, a tawny torrent in winter flood, with arms that stretch for twenty miles across the plains. What engineer could cope with such natural disadvantages, or build channels to withstand the stress of such abnormal conditions?

The Australian settler cannot by his most bitter enemy be truthfully accused of want of energy or want of pluck, but a four-year drought is a stupendous opponent, and makes heavy drains not only on energy but on wealth and health, on brains and resource, and though the Australian has as much of these as his British cousin, he has no more—and the situation remains a hard one, with the balance of power in the hands of drought, the relentless.

It seems that the settler in these afflicted districts must work out his own salvation on terms most suited to local requirements. No mortal power can prevent the destruction of grass in a drought and the consequent privations which the flocks must suffer ; but two things *can* be done—the country can be lightly stocked when a drought by all ordinary signs seems imminent, and water can be obtained by the sinking of artesian wells. The expense of the latter—the great outlay necessary—is the only possible argument against them, and any objection to go to what must be counted reasonable expense in providing a suitable bulwark to the drought's inevitable attack shows a mistaken economy which has invariably spelt disaster to those who have practised it. On the other hand, those men who have lavishly and, apparently, recklessly spent money in making such provision have never failed to reap their advantage later on in the phenomenally high prices which always obtain for saved stock at the end of a prolonged drought.

Australia's next most important and pressing problem is undoubtedly the destruction of the rabbits which have over-run her rich feeding grounds and clogged the wheels of her pastoral progress during many recent years. It was an English sportsman who, in a misguided moment, introduced a pair of rabbits into the Colony of Victoria, in the hope that their progeny might afford sport upon his estate. From a distributive and cumulative point of view, his experiment was entirely successful, and if we can hardly say that the descendants of his prolific pair afford *sport* to the Australian of to-day, they afford, at any rate, material for a good deal of hard thinking.

Spreading rapidly over Victoria, the rabbits crossed the border into New South Wales and into South Australia, where the mallee and sand of the Ninety Mile Desert afforded them a soft surface for their burrows and plentiful cover from their enemies. Northward up the Coorong they swarmed in their tens of thousands, spreading out into the saltbush country that surrounds the world-famous silver mines of Broken Hill. Further east their uninterrupted march took them to the very borders of Queensland. The settlers of that colony, profiting by the experience of their southern neighbours, determined to stop the oncoming multitude at any cost. Consequently they built a rabbit-proof fence along their border, four foot of mesh and wire, and awaited results. For a while the tide was stemmed, and the baffled army seethed backwards and forwards along the netting barrier, eating up every green thing upon the New South Wales side ; but somehow—no one is prepared to say how—a few stragglers got through or over the fence, and the Queensland lines were stormed.

Some say that young rabbits crept through the netting mesh, others that they climbed over, still others that unscrupulous bushmen put a few over, tempted by the high rates then given for rabbit scalps in the sparsely-affected districts. However it may be, the fence was crossed ; and though Queensland has never suffered from the rabbit scourge to a like extent with her neighbours, still the rabbits are there and in formidable numbers.

Meanwhile the more seriously afflicted colonies were not idly suffering the invasion. Holdings were netted at great expense, poison carts were bought and poisoned pollard was laid in large quantities, gangs of men were paid to shoot and trap and hunt with dogs, and wire and pit traps were set along the netted fences. Tens of thousands of rabbits were destroyed, but hundreds of thousands took their places in the fighting line. They became a greater scourge than the floods, a fiercer menace than the drought. As their numbers increased and the hopelessness of dealing with this new plague made itself apparent to some of the landholders, they ceased their efforts, and the brown squadrons looted and pillaged at will. They nibbled pasture and crop, and fouled the sheep-runs till even the kangaroos went wide for cleaner grass. Even the pluckier and more determined settlers were obliged to give up the fight, as they found their land re-populated by the rabbits of their neighbours. Only those who could afford to put a ring fence of small-meshed netting around their entire property had any chance of prolonging the unequal fight. Even with these it was a ceaseless battle, in which the squatter only kept the upper hand by a diligence and vigilance which were scarcely relaxed by night or day.

Up to the present time that constant war is still being waged over a wide district with a varying measure of success. On some holdings the rabbits are practically held in check. In others they ride steel-shod over the pastures, conquerors looting at will.

Many schemes have been put forward to compass their destruction, but without avail. Drought, the deadly enemy of the squatter, is also the rabbit's fiercest and most successful foe. But the rabbit outstays the longest drought ; and as soon as the rain falls his battered legions take heart of grace and multiply and replenish the earth.

A year or two ago a man named Rodier came forward with a theory of rabbit destruction which aroused considerable attention, and promoted endless discussion. His plan was that all bucks caught in wire and pit traps should be set free again, but all does caught should be destroyed, and he claimed that by this method it would be found that the number of bucks would be so large in proportion to that of females that the former would fight with one another until they were decimated and practically destroyed.

Many settlers tried the plan, only to find it too slow, and they gave it up as impracticable.

Rodier, however, fenced in his property and persevered, and to-day claims that not a single rabbit can be found upon his holding.

So terrible a scourge has this rabbit invasion become to Australia that the Government has from time to time been importuned to intervene ; without success, however, until quite recently.

For some little time the authorities of New South Wales have been in communication with Doctor Danysz, a well-known European scientist, who has offered to make an attempt to destroy the rabbits by introducing a virus among them. Negotiations have been practically concluded; £500 has been collected by public subscription to cover the cost of certain preliminary experiments, and Doctor Danysz is now in Sydney, carrying out some final laboratory trials before making his initial attempt upon a small rabbit-infested island, to which it has been deemed advisable to confine his maiden efforts in case of any accident in the way of wholesale infection of stock; though the Doctor avers that such would be impossible in connection with the virus which he will use. However his experiments may turn out, everyone who has the future prosperity of pastoral Australia at heart will wish the enterprising scientist the success which he assuredly deserves.

There are, as we have hinted above, other lesser scourges which oppress the Australian settler, but it is the rabbits and the drought which supply this great country with her two most difficult problems.

WILL H. OGILVIE.

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CANADIAN AGRICULTURE AND RURAL EDUCATION.

By JAMES W. ROBERTSON.

(*The Empire and The Century.*)

Canada is essentially an agricultural country. Most of its wealth must come from its farms. Its material prosperity, at present in sturdy evidence on all sides, rests upon gainful agriculture.

The soil, the climate, and the intelligence and industry of the people are favourable for the production of a great variety of food products of exceptionally good qualities from farms, gardens, orchards and vineyards; and the extensive sea coasts, great lakes, rivers and streams abound with the finest of fish.

Over 45 per cent. of the population of Canada are engaged in agricultural occupations. There are vast areas of fertile soil from the Atlantic to the Pacific Ocean, and the climate or climates range from sub-tropical to sub-arctic, with a rainfall varying from 67 inches per annum in British Columbia, 17 inches in Manitoba, to from 30 to 45 inches in the provinces of Ontario, Quebec, New Brunswick, Nova Scotia and Prince Edward Island.

Now-a-days, agriculture may be said to include not only the cultivation of land, but the culture of the people who live on the land. The efforts of the farmer must be directed by intelligent purpose, if he is to prove successful in maintaining the fertility of the soil, in raising and keeping livestock profitably, and in preparing products for markets. This all calls for education suitable to his needs. Such an education fits the people to derive happiness, material prosperity, and vigour of body, with strong gentleness of spirit, from their rural occupations. It is not so common now as it was to hear that sort of education sneered

at as "utilitarian" by those who hold to the mischievous notion that culture consists in acquiring and exhibiting conventional manners, and is shown at its best by a life of idleness in the midst of beautiful and luxurious surroundings. To the educated farmer that sort of thing is corrosion and corruption of the fibres of physical, mental and moral life.

The wholesome fruits of culture are satisfying and nourishing only to those who follow a worthy course of action, careless of personal ease, for some important public good. To many of us who are working for the improvement of rural education, it appears that moral courage and intellectual enjoyments rest upon, and rise from, the basis of a people like Canadians, who are intelligent, capable, and disposed to work together for the good of all ; who are well fed and well clothed ; who live in comfortable houses ; and who keep themselves perfectly clean.

Certain places are especially adapted for certain rural industries. The province of Prince Edward Island is adapted for dairying, through butter and cheese factories, but that business was going backward for want of information and education. In the year 1892, with the assistance of money given by the Dominion Government, one co-operative cheese factory was started at New Perth, in Prince Edward Island. The machinery was lent by the Government. An instructor was sent to organize the business, and to arrange the locality into routes for the convenience of those supplying milk. The factory was managed as a Government dairy station, an an object-lesson for the education of the people in co-operative dairying. In the autumn of 1892 I took the liberty of exporting to London \$3,600 (£720) worth of cheese manufactured at that station, and I can recall the remonstrances of some of the people against risking their cheese in any steamer. I got fault-finding letters asking me why I did not sell the cheese at home, or in Halifax, Nova Scotia. The cheese was delivered in England, and was sold there for the top market price. Some of it, indeed, sold for sixpence per hundred-weight more. I angled for that sixpence and got it. Then, when the island people knew that they had got sixpence per hundred-weight more for their cheese than was paid for any other Canadian cheese sold that day in London, it put new faith, hope and courage into them. That was the beginning of the export of cheese from Prince Edward Island—to the value of \$3,600. At the taking of the census in 1891 the four cheese factories in Prince Edward Island were put in the returns as having an output worth \$8,448 (£1,689) ; ten years later, when the census of 1901 was taken, there were forty-seven cheese and butter factories, with an output valued at \$566,824 (£111,365) approx. There is an instance of the result of organization and education! There had been no increase in the number of cows kept. The change had been in the quality of the intelligent labour applied to the conditions. The people now run their own factories, and have repaid to the Government every dollar that was lent to them. There is no part of agriculture that is not susceptible to the same kind of improvement.

Here is another instance on a larger scale. The province of Ontario is noted for the products of its cheese factories and creameries. It made great advancement in quality and in quantity as between the

two census years 1891 and 1901. The province of Quebec had not advanced so far in co-operative dairying; but a beginning had been made in organizing its cheese factories, employing the services of a travelling instructor. In 1892 a dairy school for the province of Quebec was started by the provincial authorities; and the Department of Agriculture of the Federal Government at Ottawa authorised me, as Commissioner, to turn in $3,000 (£600) a year of federal money to help the dairy school at St. Hyacinthe—to promote dairying and agriculture by means of education. We did not call it education. That might have been an unconscious slap at the Constitution of Canada, which, by the British North America Act, is said to reserve all legislation affecting education to the exclusive jurisdiction of the Provincial Legislatures. We began by giving short courses. Some of the wiseacres said it was foolish to think of imparting any education worthy of the name in a two weeks' course. However, we made it a rule that only students should be admitted who had worked for one year in a cheese factory or butter factory. We had neither the time nor the money to devote to those floating atoms who, in an indefinite way, wanted a college education for dairying. No one could get the course at St. Hyacinthe unless he had previously had one year of practical experience. These were the very people we wanted to help. These were they who needed help. Then, the provincial authorities went further in organising the factories into syndicates. No one was allowed to become a syndicate instructor unless he had taken the course, or courses, of instruction at the St. Hyacinthe Dairy School. During the first year (1892-1893) 214 students took the course; the next year there were 268 students; in the third year 328, and so on. The people of the province of Quebec were generally supposed to be far behind those of Ontario in education and co-operation as applied to dairying and agriculture generally. The returns in the census of 1901 revealed some of the results of the educational campaign. Ontario made great progress, but Quebec made much more. The following table is indicative in part of what was accomplished :—

Value of Product from Co-Operative Butter and Cheese Factories as Returned in the Two Census Years 1901 and 1891.

	Ontario.	Quebec.
Value in 1900	$14,706,303	$12,261,898
Value in 1890	7,569,338	2,918,527
Increase	$7,136,965	$9,343,371

The development of this industry, which has increased the desire and capacity of the rural populations to co-operate in other ways, is traceable directly to education and guidance towards organization. I believe that similar means would be equally effective in the whole range of agriculture, from the cultivation of the soil to the preparation and shipping of products to ultimate markets.

In 1899 I arranged a competition among Canadian boys and girls in the selecting by hand of large heads of wheat and oats. Each competitor gathered 100 of the best heads he or she could find, and forwarded them to me. One hundred dollars in cash prizes were provided, and awarded to the successful competitors. In 1900 Sir William C. Macdonald, of Montreal, gave me the sum of $10,000 (£2,000) to be distributed in prizes to the successful boys and girls living on Canadian farms who entered into a competition in the growing and selecting of seed of wheat and oats, according to the plan outlined. Each competitor was required to operate a seed-plot consisting of not less than one-quarter acre during each of three consecutive years, and each year to select from the ripened standing crop of the seed-plot enough large heads of wheat or oats from the most vigorous and productive plants to provide well developed seed for the seed-plot of the succeeding year. The operations of the competitors were inspected from time to time during the term. The parents of the 450 competitors who completed the three years' work were found, as a rule, to be among the best farmers in the localities where they reside. During each of the three years 100 heads were selected and forwarded to me for examination. These were separately threshed, and the cleaned grain was counted and weighed. Certified reports, showing the yield from the quarter-acre seed-plot, were also received from each competitor.

The increase in the large heads from the crop of 1900 to those from the crop of 1903, on the average for all Canada, was 18 per cent. of increase in the number, and 28 per cent. in the weight, of grain per 100 heads of spring wheat ; and 19 per cent. of increase in the number, and 27 per cent. in the weight, of grain per 100 heads of oats.

The export commerce of Canada in farm products is growing very fast. The following table shows the value of the exports of Canadian agricultural and animal products in three years, typical of the expansion in the last twenty :—

Value of Exports of Canadian Agricultural and Animal Products.

1884 (year ending June 30)	.. ..	$34,224,195
1894 „ „ „	.. ..	47,802,859
1904 „ „ „	.. ..	100,950,992

Canada has still large areas of unoccupied wheat lands of great fertility. From all I can learn regarding those of the vast North-West (and the data are not very exact, full, or clear), I incline to the opinion that 200,000,000 bushels of wheat or its equivalent may be furnished for export from that region within the lifetime of the youngest farmer settled there.* One must bear in mind the limitations of production per acre over periods of more than fifteen and twenty years where wheat is the only or chief crop, without such a system

*In round figures, that would suffice for the present import demand of the United Kingdom.

of rotation of crops as will hinder weeds from taking full possession of whole districts. That turns one to regard with increasing confidence the capacity of the undeveloped agricultural resources of the older half of Canada (lying between the prairies, or, rather, between the great Lakes Superior and Huron and the Atlantic seaboard) to supply the larger share of the requirements of the United Kingdom for imported foods. The exportation of wheat has played a minor part in the agricultural prosperity of the country. That is made evident by the following table of value of exports. I have put the average figures of five years into each of four periods during the last twenty years to eliminate the presentation of temporary fluctuations which might mislead, and I have held to the use of values rather than quantities in this article, as being the more serviceable means towards giving correct and clear impressions to the citizen of the Empire who reads it.

Average Annual Value of Exports of Canadian Products, 1885 to 1904 inclusive.

Period	All Agricultural and Animal.	Wheat and Flour.	Percentage of Total Values in Wheat and Flour.
1885-1889	$40,022,251	$3,788,922	9.4
1890-1894	46,140,673	5,849,789	12 6
1895-1899	60,997,319	10,680,534	17.5
1900-1904	95,129,793	19,438,380	20.4

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GOVERNMENT HAIL INSURANCF

(*North-west Farmer.*)

The Government Commission appointed to investigate hail insurance affairs in the province of Manitoba has issued the following circular, and has asked for an expression of public opinion on the proposition therein contained :—

"The Commissioners appointed by the Manitoba Government to investigate the condition of hail insurance matters in the province, having reported on the methods of the companies now doing business, adjourned until Tuesday, July 10th, to allow those interested in a Government system of hail insurance to place their views before the Commission. Several farmers and others who have given the subject some thought have submitted their views, the concensus of which appears to be definitely in favour of a Government system, but along varying lines.

"The Commissioners have further adjourned until November 27th, to allow sufficient time for this important question to be taken up by Boards of Trade, Municipal Councils, conventions of farmers,

and all other interested bodies, and earnestly urge that the subject be fairly discussed on its merits in the interests of our most important producing community, and the conclusions arrived at be forwarded to the chairman or secretary of the Commission before the date given, so as to allow the matter, if favourable, to be put in proper shape to be submitted to the Lieutenant-Governor in Council prior to the opening of the next session of the Legislature.

"The Commissioners, while recommending no specific plan, are desirous of obtaining a general opinion on the advisability of a tax on all assessable lands in the province, collectable through the Municipal Commissioner's office, for the purpose of paying all losses by hail up to a maximum of \$5 per acre for a total loss. This system appeals to them as the simplest and most workable of any plan submitted, involving only a trifling charge per acre or quarter section, and would secure uniform relief to all farmers who might be unfortunate enough to be visited by hail.

"From the evidence furnished the Commissioners, it would appear that about 2 per cent. of the total acreage in crop in 1905 was damaged by hail alone. This would represent some 80,000 acres, which, on a basis of a total loss throughout, would mean that \$400,000 would have to be provided. The assessable area of the province is 15,889,832 acres, and, to cover the above approximate liability in 1905, about 2½ cents per acre would have been required to be levied by the Municipal Commissioner to cover all losses. The evidence, however, goes to show that the average loss is only about half the crop, which, of course, would reduce the levy to 1¼ cents per acre.

"The Commissioners looked into the question of an assessment on cultivated lands only, along the same lines, but are of opinion that it would not be workable, owing to the expense which would be incurred in obtaining annually the correct acreage, besides other obvious difficulties."

There is much that may be said both for and against the system recommended by the Commission. It is probably the simplest and the most easily and cheaply administered system that could be devised. It has also the merit that it affords a means of compelling land speculators and others holding vacant lands to contribute something, at least, to the general advantage. But while the system may be simple, and may afford another means of taxing the parasites that are growing rich on the unearned increment, it can scarcely be claimed for it that it is equitable and fair to all concerned.

There are large areas of assessable lands in the province that are not devoted to grain raising, and in all probability never will be. There are whole communities in Manitoba that are gaining their livelihood almost exclusively from stock raising or dairying. These people are turning to a useful purpose land that is worthless for grain raising; and they have absolutely nothing to gain from a system of provincial hail insurance. It is, therefore, pretty hard to justify a tax on these people for the exclusive advantage of their fellow citizens who are

occupying the more valuable lands of the province. The proposal is still less defensible in that it contemplates a per acre tax instead of a tax levied on the assessed value of the land.

A still further objection to the proposed system is that it would insure everyone with the Government whether he willed it or not ; and it would thereby be an unwarranted expropriation of the business of the established hail insurance companies. After an extended and thorough investigation, the Hail Insurance Commission found that, with the exception of one company, which is now out of business, the hail insurance companies at present established and operating in Manitoba have been conducting their business in a legitimate and honourable way, and that the protection afforded by these companies is, on the whole, very satisfactory to their patrons. Now, whether wisely or not, the people of Manitoba have given to these companies a charter to conduct a hail insurance business within the province; and it requires the expenditure of a good deal of time, business ability, and money to get a business of this sort properly organised and established. These companies have, therefore, vested rights that all fair-minded people must admit and respect.

RURAL REPORTS.

BELFAST.

September.—There have been general soaking rains throughout the district on the 18th and 20th of this month, and a local and very slight shower on the 12th. The heavy rain on the 19th was preceded by a cold gale which killed many young lambs on the unprotected farms in the Dullstroom area. Ploughing is being done on all farms, and mealies and potatoes are being planted. It is not anticipated that the area cultivated will be increased as farmers are paying more attention to stock farming. Winter forage is generally looking well, and the early rains will have done much to improve it. The sheep and goats have nearly completed lambing, and, on sheltered farms, the season has been successful. Large losses are reported by certain farmers, both owing to the poverty of the dams and the cold spell preceding the rain. The market prices of slaughter oxen are £12 to £15, sheep and goats £1 to £1 5s.

October.—Good rains fell at the beginning of the month, hail-storms which did a considerable amount of damage in some parts of the district, but not too much; latter part of month windy and dry, and a slight frost on the 28th. All farmers were busy ploughing during the month, but have now ceased on account of the ground being too dry for further ploughing. Mealies, oats, manna, potatoes, and also a little lucerne and mangols have been sown. The winter forage and wheat are looking very well, and should give a heavy crop. All stock are looking well after the cold winter months, cows are calving, sheep and goats have lambed. The current market price of mohair is 1s. per lb., wool, 7½d. per lb.; slaughter oxen, from £10 to £15; Angora goats, 18s. to 25s.; Merino sheep, £1 to £1 10s.; bastards, 20s. to 25s. Natives are being paid from £1 10s. to £2 10s., and £3, and yet several people complain of not being able to work for the want of native labour.

November.—Slight showers of rain fell during the month which were rather cold for the time of the year. Nearly all farmers have finished ploughing and sowing, others are still sowing summer oats and manna, and several have been busy cutting forage. A fairly good crop has been reaped. The prospect of crops so far, and in most cases, is very promising, except in some parts where insects are doing a lot of damage to potatoes and mealies. All stock are looking well. Trek and slaughter oxen are fetching from £12 to £14. Sheep and goat ewes are still dear. No change in native labour since last report.

BETHAL.

September.—A few showers have fallen, but it is still dry. There were strong winds in the middle of the month and some frosts towards

the end. A few farmers have begun to plough, but not enough rain has fallen for ploughing to be general. A hard frost cut off the bloom from the fruit trees during the last week of the month, and prospects seem rather poor for a good crop this year. The current price of mealies is 11s. per 200 lbs., and forage 5s. per 100 lbs. Live stock are not looking well; grass is very scarce. Sheep are somewhat poor, especially those with lambs, among which there has been great mortality. The native labour supply meets demand—pay £2 10s. per month. A Government bore on Mr. Wilmot's farm was at work with the result that abundant water has been obtained at a depth of about 120 feet.

October.—There was abundant rain—nearly five inches—during the first half of the month, which was also cold and windy. The second half of the month was hot and dry. There have been several hailstorms, the severest on the 16th. On some farms the hailstones were so large that they made holes in corrugated iron buildings. There has been considerable ploughing done on many farms, and crops planted early in the month are now above ground and looking well. Towards the end of the month ploughing has been discontinued on account of the ground getting hard and dry. The current price of mealies is 11s. per 200 lbs., and forage 6s. 6d. per 100 lbs. The stock appear to be picking up on the new grass and are looking well. Native labour meets the demand at from £1 to £2 10s. per month and food.

November.—For the month of November the weather has been colder than is usual. Rain has been frequent. Ploughing is well advanced throughout the sub-district, the sowing of the old lands being nearly completed. There promises to be a big area under cultivation this year. Mealie crops are looking well, but appear to be a little backward owing to the cold weather; also potatoes. Fruit appears to be more abundant in some portions of the sub-district than others. This is due to the presence or otherwise of hailstorms. Vegetables are doing satisfactorily. The current prices of various crops are:—Mealies, 13s. to 15s. per 200 lbs.; manna, 5s. per 100 lbs.; forage, 5s. 6d. to 6s. 6d. per 100 lbs. Live stock are in good condition. The veld is green and water is plentiful. The supply of native labour is plentiful, and the average wage is £2 per month.

Boksburg.

September.—Rainfall for the month, 1.22 inches. The weather has been bright and genial with the exception of one week which was very windy. A slight frost was experienced in the distrct at the end of the month. Fruit trees are looking well, although in some parts the green fly did a lot of damage, particularly to peach trees. Ploughing started in earnest after the first good rain. Vegetables are still scarce and of rather poor quality. However, the rains did a lot of good. The current market prices are as follows:—Mealies, 14s. to 15s. per bag; potatoes, 9s. to 12s. (inferior); manna, 14s. to 15s. per 100 bundles; fowls, 3s. to 4s. 6d.; eggs, 1s. 9d. to 2s. 6d. The veld is looking much improved although, at one time, rather dry.

Live stock are in fairly good condition. Native labour is fairly plentiful for domestic purposes.

October.—Rainfall 1.75 inches. Weather warm and brilliant, slight hailstorms but not doing any damage. Mealies looking well in lands along the spruits. Ploughing is now nearly over for mealies and Kaffir corn. The fruit trees are looking well and giving promise of good crops. The late September rains have benefited the veld tremendously and all live stock are beginning to improve. No change in native labour since last report.

November.—Rainfall for November, 3.05 inches. The weather has been warm and bright. Mealie gardens and crops in general are in fair condition. The fruit crop this season will not be above the average as regards quantity, although the quality will be good. At present fruit on local market is scarce, dear, and of an inferior quality. The current prices are as follows:—Mealies (yellow), 15s. 6d. per bag; mealie meal (white), 15s. per bag; potatoes (fresh), 20s. per bag; red, 15s. to 18s. per bag; forage, 21s. per 100 bundles, medium; lucerne, 4s. 6d. per bale; chaff, 9s. 6d. to 10s. per bale. All live stock are in good condition and the veld is looking well. Native labour supply is indifferent.

CAROLINA.

September.—The rains commenced in the latter part of this month, and there was a good downfall all over the district on the 20th and 21st. The rain was followed by cold weather and a few slight frosts which, however, appear to have done no damage. The farmers' prospects for the coming season are exceptionally good. Ploughing is in active progress everywhere. Winter crops of wheat and oats are looking well. Fruit has set well in the orchards There is now young grass for the stock and cattle, and sheep are rapidly regaining condition. All spruits and fountains are running well and dams are full after the good rain. Vegetables are scarce and farm produce fetches good prices:—Forage, unobtainable; manna, 20s. to 25s. per 100 bundles; mealies in strong demand at 12s. a bag. As is usually the case at this season of the year there has been some loss amongst the cattle from "tulp." Native labour is scarce owing to the demand of the railway construction contractors and the local mines. Rate of pay £3 per mensem.

October.—The meteorological conditions during the month have been very favourable; there have been frequent rains in good quantity. Hailstorms have been reported, but, except in certain localities they have done no damage, though fruit trees were thinned to some extent by the hail, there is more than sufficient fruit left on the trees to ensure a good crop. The ploughing for the summer crops is nearly completed, and a larger area is now being planted than in previous years. Winter crops of forage, etc., will shortly be ready for cutting. Live stock is in good condition, farmers are shearing, and a certain quantity of wool is coming in. Good foals have been thrown by mares to the Government stallions which were at stud in

this district last season, and mares are being brought freely to the stallions at present. Farmers are anxious to secure thoroughbred stock, and some yearlings and two-year-olds have been sold by local breeders at good prices. Practically no produce is being offered at present; a few vegetables are brought in, but, to meet the demand, vegetables are imported from Barberton.

November.—Meteorological conditions continue exceedingly favourable; rains to the end of the month have ensured the starting of the summer crops, and fine weather at date has given farmers with ripe winter crops the opportunity to cut and garner them. The winter forage crop is now being brought to market and proves very good and full. Summer oats show a little rust, but all other crops are good. Live stock are in good condition. Produce prices: Forage (new), 6s. per 100 lbs.; mealies, 13s. Vegetables fetch remunerative prices.

Ermelo.

September.—On the 19th a misty rain set in from the east which continued until the evening of the 21st, when heavy showers fell in the south-eastern portion of the district. A heavy rain fell on the night of the 22nd. These rains were fairly general, close upon 2 in. having been registered. Fairly severe frosts ensued on the nights of the 25th and 26th. Following upon the rain, ploughing was immediately commenced and is proceeding at the present time. The live stock in the centre and western portion of the district are in fair condition but poor towards the eastern portion. It has been reported that some of the settlers have lost a number of stock during the period of rain above mentioned owing to their poor condition and the cold. The grass is rapidly growing and stock will soon be in good condition throughout the district. Native labour is very scarce indeed, no boys being available either for domestic, railway or roadmaking purposes. The reason may perhaps be explained by the fact that many are at home putting in their crops, and many more are away at work in other labour districts. A Government bore is at work at present on the farm of Mr. D. de Wet, of Brakfontein 63. Boring has been carried on to a depth of about 130 feet, and, so far, a supply of about 100 gallons per hour has been struck.

October.—Rain fell on almost every day between the 6th and the 24th, a rainfall of nearly 6 inches having resulted during the month, the most in one day having been 1.40 inches. Violent thunder and hailstorms accompanied the rain, the latter occasioning great damage to buildings, trees and stock, the hailstones having been unusually large, being jagged masses of ice measuring in some cases 8½ inches x 6½ inches. Owing to the soaking rains which fell, a vast amount of ploughing, sowing and planting have been accomplished. The crops are progressing favourably, but the fruit crop in district has practically been ruined in certain areas by hail. All live stock are gaining condition quickly owing to the good growth subsequent on the early rains, and, given good late rains in the autumn, winter fodder would

only have to be provided for a short period. There is a great scarcity of native labour, this being attributable to the season when most natives are employed agriculturally on their own lands. The current rates of pay are from 10s. to 15s. per month on farms, and from £2 to £3 per month in towns. A fair lot of Rambouillet and Vermont rams have been brought into this district by Mr. Weatherall for sale to the farmers.

Heidelberg.

September.—Rain, accompanied by very high wind, has fallen throughout the district. Ploughing has commenced. The fruit crop shows excellent promise. Horses and cattle are in fair condition. Sheep have suffered, lambs being slaughtered to save the ewes during the earlier part of the month, and, later on, the one instance of lambs being lost owing to the cold and want of shelter.

October.—Very nice rains fell throughout the district during the beginning of the month. As no rain fell during the latter part of the month the country became dry again. Cultivation has been carried out all over the district on account of the soaking rains that fell during the beginning of the month. The oats, etc., which had suffered considerably through the drought, picked up well after the rains, and things look more promising. Mealies and oats are the only crops obtainable now, for which 14s. a bag, and about 25s. per 100 bundles are obtained, respectively. Stock look fairly well, and will now pick up well after the rains. Horses and cattle are still healthy. Native labour is still scarce.

November.—In some parts of the district nice rains have fallen, but, in others, it has rained very little. A good deal of ploughing has been done, and in those parts of the district where good rains have fallen, crops look very promising, whereas in the drier parts they look fairly well. The oat harvest appears to be good. Through late cold winds, fruit will be very scarce at some parts. In town and other farms, again, a good crop is anticipated. Mealies and oats are practically the only crops obtainable. The price of mealies is about 12s. 6d. per bag, and oats 25s. a hundred bundles. Live stock generally are in good condition. If it does not rain much before winter there will again be scarcity of water on some farms. Native labour is not quite so scarce now as a few months past.

Klerksdorp.

September.—The weather is getting warmer. Some very destructive and severe wind storms were experienced, followed by a little rain, in all .12 inches. Crops are progressing favourably under irrigation. If early rains are experienced, and, before the streams fail, a good crop is anticipated. Vegetables and fruit continue to be very scarce. The current market prices of some crops are as follows:—Forage, 20s. to 26s. per 100 bdls.; Kaffir corn, 10s. to 12s. per 200 lbs.; mealies, 11s. to 13s. 6d. per 200 lbs.; potatoes, 11s. to 20s. per 160 lbs. Live stock are in fair condition on the whole. The veld is

commencing to sprout. Water is getting very scarce and Schoonspruit has ceased to flow. Native labour is same as usual.

October.—Hot and variable winds prevailed during the month. Rains fell early in the month registering in all 2.02 inches. Farmers have started to plough and prepare their lands for summer crops. The rains early in the month saved the winter crops which were beginning to suffer from the heat and drought and the failure of the perennial streams. Farmers are busy harvesting their crops, and the new forage is being brought in to market in small quantities, fetching from 10s. to 18s. per 100 bundles; Kaffir corn, 11s. to 12s. per 200 lbs.; mealies, 11s. to 13s. per 200 lbs.; and potatoes, 16s. to 25s. per 100 lbs. The live stock are improving and the veld has much improved, but more rain is required. There is no improvement in the labour supply.

LICHTENBURG.

September.—Rain fell on two days. The total rainfall was .7 inches. There were 3 degrees of frost on the 26th of the month. Good rains have fallen in several parts of the district, and farmers are busy breaking up ground. Crops of oats and mealies are looking well. Vegetables are scarce and expensive. The current price of Kaffir corn is 10s. per bag, mealies 11s to 12s. 6d. per bag, and potatoes 18s. to 27s. 6d. per bag. The veld is poor owing to ravages of locusts. Native labour is scarce as usual.

October.—Rainfall for the month, 1.53 inches on 8 days The early rains enabled the farmers to start ploughing for maize and Kaffir corn sooner than usual. A good deal of seed has already gone into the ground The wheat and oat crops are forward and well up to the average. The current market prices are:—Mealies, 10s to 13s. per bag; Kaffir corn, 9s. to 11s. 6d.; potatoes, 2d. to 7d per lot (the latter averaging 1d. per potato). Vegetables are getting a little more plentiful, but are still very expensive. The severe winter has left its mark on both cattle and sheep. Since the rain, however, the veld has come on rapidly, and all classes of stock are regaining condition. Native labour is very scarce. The Government water drill returns to the district this week. Very good work was done in the latter end of 1905 and beginning of 1906, and sufficient applications have come in to keep the drill busy for some time to come. Voetgangers have made their appearance. The Locust Officer gave a practical demonstration of the spraying system on a swarm about eight miles from town. Spraying pumps and material are now in hand and are being distributed to the different South African Constabulary out stations and to farmers who require them.

November.—Rainfall for the month, 2.84 inches on 10 days. Ploughing and sowing of maize and Kaffir corn have been going on throughout the month over nearly the whole district, and the early rains have enabled farmers to get under an exceptionally large area. Harvesting of wheat and oats is in full swing. These two crops are well above the average this year. The current market prices are:—

Mealies, 12s. to 13s. per bag; Kaffir corn, 12s. 6d. per bag; oathay, 5s. per 100 bundles; potatoes, £1 to £1 5s. per bag, 4d. to 9d. per lot (about 4 lbs. to 7 lbs.) Vegetables are getting more plentiful, but are still very expensive. The veld is in fine order, and live stock of all descriptons are looking well. Native labour is still scarce. The Government water bore has returned to the district, and has begun work for the Lichtenburg Municipality.

Marico.

September.—Rainfall, 0.02 inch on 1 day. Mean maximum temperature, 81.9 degrees F.; mean minimum temperature, 48.9 degrees F.; mean force of wind, 141.4 miles per day; mean relative humidity, 44.5%. Farmers have commenced reaping oats, which is of excellent quality. A number of loads have already been disposed of on the market. Fruit is setting nicely; on account of the cold weather experienced last month the quantity of fruit, *i.e.*, stone fruit, will, it is afraid, leave a good deal to be desired. The market has been better supplied this month than the previous one, potatoes ruling very high, as much as 40s. per bag has been paid for best Early Rose; new forage, 5s. to 6s. per 100 lbs.; mealies, 12s. 6d. to 13s. 6d.; Boer meal and wheat scarce; firewood plentiful and cheap. Native labour is scarce.

November.—Rainfall, 7.38 inches on 11 days. Total rainfall since 21st September, 11.11 inches, 723 days, *i.e.*, in advance of last season (to 1st December), 7.81 inches. Mean maximum temperature, 82.36 degrees F.; mean minimum, 57.03 degrees F.; mean relative humidity, 57.7%. Farmers have completed harvesting, and are now busy ploughing in mealies, which, on account of the heavy rains throughout the month, is being done on quite an unprecedented scale; almost every inch of available land is being brought under cultivation. Fruit trees are doing very well, except apricot trees, which show very little fruit this season throughout the district. Except in potatoes, the market has been fairly supplied. Current prices:—Mealies, 12s. 6d. to 14s.; wheat, 20s. to 22s. 6d.; potatoes, 25s. to 30s. per bag; firewood, 8s. to 15s. per buckwagon load. Live stock is improving, and so is the veld. The rivers are all flowing, which, considering the severe droughts during the last few years, is quite an unusual thing. No change in native labour.

Middelburg.

September.—Owing to rains which, according to local opinion, are the best which have fallen for many years, the prospect of success in farming operations is much improved. Farmers are busy ploughing and seeding throughout the district, and winter crops of forage, greatly assisted by the rains, are nearly fit for harvesting and looking remarkably well. The fruit crop promises to be a good one. Forage is very scarce, and is realising good prices, 8s. 6d. to 9s. per 100 lbs.; mealies, 10s. to 12s. per 200 lbs.; Kaffir corn, 15s. per 200 lbs. Stock

are in low condition. The pasturage, however, having had a thorough saturation, an improvement will very soon be discernible. Native labour is still very scarce—rate of pay from 30s. to 40s. per month.

October.—Heavy rains have fallen during the month, and two very severe hailstorms did considerable damage to crops in the Tautesberg Sub-District where the rainfall registered 4.42 inches. Ploughing is being carried on generally. Large fields of forage having been destroyed by hail, it is intended to ensure a return of some sort by sowing such lands with mealies. Forage is being harvested in localities which escaped the almost general visitation of hailstorms, and the crops are good ones. The wheat crops in Mapoch's ground are exceptionally fine, but not yet fit for harvesting, and if they escape destruction by hail, will yield excellent returns. Fruit trees are looking well where not damaged by hail. Stock are now in good condition, grazing being very good and water plentiful. Native labour is scarce—rate of pay £2 per month.

November.—The weather during this month has been windy, with heavy thunderstorms, copious rains and some hail. A great deal of ploughing has been done for summer crops. The harvesting of wheat and oats has been carried on in those localities which escaped devastation from hailstorms. Fruit trees are looking very promising on most farms. The average price of oathay—the yield of which is good—is 7s. per 100 lbs.; mealies are becoming scarce, 12s. for 200 lbs. Live stock is in first-class condition; veld grass for grazing purposes and water are plentiful. Native labour is scarce—rates of pay from 30s. to 40s.

POTCHEFSTROOM.

September.—Weather erratic. Alternately calm and windy. Boisterous days. Rain fell on three days, total, .13 inch, as compared with .76 for September last year. In some parts of the district rains have fallen registering .50. Owing to the lateness of the rains, ploughing has not yet started except in those parts where a little rain has fallen. A good quantity of potatoes has been planted. All crops under irrigation are looking well. The fruit season promises to be a good one. The current market prices are:—Mealies (yellow), 12s. 6d. to 14s. per bag; mealies (white), 12s. to 13s. per bag; Boer meal, 28s. to 30s. per bag; forage, 28s. to 30s. per 100 bundles; potatoes, 12s. to 17s. 6d. per bag; chaff, 3s. to 5s. 6d. per bale. Stock are looking well considering the bad state of the veld after the winter. The feed is poor and rain is badly wanted. Native labour is insufficient and wages are high. The farmers are beginning to realise the advantages of this district as a sheep-rearing centre, and large numbers of sheep have been imported from the Cape.

October.—Occasional high winds. Rain fell on six days, registering 2.21. Heavy hailstorms have fallen in the eastern part of the district doing much damage to crops and fruit trees. Ploughing has started and crops have been sown, but there has been insufficient rain to produce any result. On the farms Blyvooruitzicht and Elandsfon-

tein 289, whole crops of oats have been almost entirely destroyed, and the fruit trees badly damaged by hail. Strawberries are plentiful at 1s. per lb. Stock are in fair condition. Native labour is insufficient.

Standerton.

September.—Winds have prevailed the greater part of the month, and frost throughout the district for a few days. Steady showers of rain fell towards the end of the month. Most of the farmers have started ploughing and sowing, principally mealies. The fruit trees in the district are making good progress, and are in advance of previous years, and a good number have also been planted throughout the district since last fruit season. The condition of live stock is poor, and the sheep are the principal sufferers, losing a number of lambs through want of pasture. Native labour conditions remain unchanged.

October.—Rain has been plentiful during this month with heavy thunder and hailstorms which did great damage in some parts. Ploughing is now in full swing, and farmers are busy sowing mealies, manna, oats, etc. A fair quantity of vegetables has been planted and is coming on well. The potato crop points to a good harvest. Fruit trees have been damaged a little by the recent hailstorms, but, notwithstanding, there are good prospects of a large yield this season. Live stock are in very good condition generally and are picking up very rapidly, grazing being abundant now, and water plentiful. The lambing season has turned out good. Native labour sufficient for demand—wages from £2 to £2 10s. per mensem.

November.—Heavy fall of rain throughout the month with some hailstorms. Ploughing is now almost completed, and sowing is in full swing. The early crops are well advanced, and agricultural operations so far give great promise. Live stock are in splendid condition. Water is abundant and grazing excellent. Native labour scarce—rates of pay from £1 10s. to £2 and £3 per month.

Volksrust.

September.—Maximum temperature 84.0 on 17th. Minimum temperature 29.3 on 26th. The dry spell was broken and 1.40 inches of rain fell on six days. Two hail storms occurred, but as they were unaccompanied by a strong wind and the hail small, little damage was done. A severe frost on the night of the 25th did considerable damage to fruit trees, 3 degrees of frost were registered. A good deal of wind was experienced during the month. The welcome rains came as a great relief to the farmers, and tilling operations have commenced in earnest. Things are much brighter than a month ago. Present price of crops :—Mealies, 12s. per bag ; potatoes, 16s. 6d. per bag ; forage, 6s. 9d. to 7s. 6d. per 100 lbs. Horses, cattle, etc., are still in poor condition, but the grass is growing quickly, and improvement should soon be noticeable. Water is now plentiful. Work is still stagnant and no improvement likely.

October.—The weather during the month has been very seasonable. Welcome rains have fallen, the rainfall totalling, for 13 days, 4.33

inches. Several hailstorms passed along the adjacent hills, but locally the damage has not been great. Maximum temperature 86.4, on 23rd. Minimum temperature 37.2, on 11th. Ploughing and planting have been vigorously pushed forward during the month, and generally the work is much more advanced than it was this time last year. The following are some prices of last year's produce :—Mealies, 12s. per bag ; potatoes, £1 to £1 2s. 6d. per bag ; forage, 6s. 9d. to 7s. 6d. per 100 lbs. Stock generally are improving, and there is now abundant grazing. Nearly all stock have now returned from the Low Veld. Water is now plentiful in the district.

November.—Maximum temperature 86.0, on 3rd. Minimum temperature 40.0, on 19th. The month has been remarkable for extraordinary rainfall—7 inches has been recorded for 13 days. Surprisingly cold winds have been experienced, some days quite winterly. Owing to the cold winds crops have practically made no progress during the month. Warm weather is badly needed to help them on. Prospects generally are bright, and with favourable weather the hopes expressed a month ago should be realised. The fruit crops generally should be good, except in the places caught with the hail storms. In some cases the potato crop has been ruined with the excessive rain. New potatoes are coming on the market in very limited quantities. Prices last year's crops :—Mealies, 12s. to 14s. 6d. per bag ; potatoes, 10s. to 12s. per bag ; oat forage, 6s. 9d. to 7s. per 100 lbs. Live stock generally are looking very well. Grazing is abundant. Work is very slack, and there are no prospects of improving.

WAKKERSTROOM.

September.—Very dry with occasional strong winds till the 19th, when a heavy hailstorm came, followed by three days of wet weather. Frost followed on this. Fair weather towards end of month. Ploughing and sowing of mealies commenced after the first rain. Garden seeds have been put in, and young fruit trees transplanted, also timber trees. Winter-sown forage is coming on well. Mealies are going up in price, up to 11s. and 11s. 6d. towards end of month ; forage up to 20s. and 25s. per 100 bundles (of 4 lbs.) ; potatoes 17s. and 18s. per 150 lbs. Horned cattle are in poor condition after the first cold rains, the weaker ones required careful feeding and attention. Sheep are very poor, many lambs dying from poverty and exposure to the hail—in one case 306 lambs belonging to one farmer died from the effects of the hail-storm on the 19th, and the following three cold wet days and nights. Native labour is as usual.

October.—Heavy rains fell throughout the month, with intervals of fine weather between. Hailstorms and thunderstorms were frequent. Ploughing of land and sowing of mealies went on vigorously during the month ; potatoes planted, oats sown, and nearly all vegetables. The prospects of fruit harvest are good, except in those parts visited by the hail. There is a vast improvement in the condition of all classes of stock consequent on the rains. Native labour as usual.

USEFUL FACTS AND FIGURES FOR FARMERS.

RINGING PIGS.

Some are indifferent as to this, and never ring pigs ; others ring every one systematically, and this is undoubtedly the best way. Pigs that have no rings in their noses are terrible torments. If kept in the stye they are constantly trying to upset the floor, and very often succeed in spoiling it completely. If they are at liberty in the fields they will burrow, particularly in the pastures, and make the surface in such a state that one has sometimes to look twice to see whether the field is a ploughed one or a grass one, and this is not only destructive but extremely untidy. It gives the impression that the owner does not care how things go, and that he is not of a progressive nature. But the cheap and simple process of ringing will stop all this as far as the pig is concerned, and all pigs should be rung just before being weaned or soon after. It does not affect them in the least, and they eat, drink, and are as merry immediately after as before. It is very much easier to ring them when little pigs than attempting it when they are savage sows or boars. Little bits of sniffling rings are sometimes used, but good strong ones are the best preventative against the most objectionable of their habits of turning the floors and fields upside down. Any handy-man on the farm can ring pigs as efficiently as a veterinary, and a great point is not to omit one.—"The New Zealand Farmer, Stock and Station Journal."

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To Soften Hard Water.—Add a little borax. Water thus softened is wholesome for cooking purposes, and is useful in the laundry for whitening clothes and effecting a saving of soap.

To Clean Marble.—Take 2 oz. of Scotch soda, an ounce of powdered pumice stone, and one ounce of finely powdered chalk. Sift these ingredients through a fine sieve, and mix with water. Rub well over the surface of the marble until the stains are removed, and then wash off with soap and water.

Lamp wicks should be soaked in strong vinegar and then well dried before using them. This precaution will ensure a better light and a freedom from smoked lamp chimneys.

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HOW TO MAKE AXLE GREASE.

The recipe given here for this purpose is that of "Booth's Axle Grease." The following are the directions given in the original patent : Dissolve ½ lb. soda in 1 gallon of water ; add 3 lbs. of tallow and 6 lbs. palm oil (or 10 lbs. palm oil only) ; heat them together to 200 or 210 deg. F. ; mix, and keep the mixture constantly stirred till

the composition is cooled down to 60 or 70 deg. F. A thinner composition is made with ½ lb. of soda, 1 gallon of water, 1 gallon of rape oil, and ¼ lb. of tallow or palm oil.—"Trade Secrets."

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PLANTS PER ACRE.

Feet Apart.	Number of Plants.	Feet Apart.	Number of Plants.	Feet Apart.	Number of Plants.
2	10890	9	537	20	108
3	4840	10	435	21	98
4	2722	12	302	25	69
5	1742	15	193	30	48
8	680	18	134	35	35

Rule.—Multiply the distance into each other, and with the product divide 43,560 (the number of square feet in an acre), and the quotient is the number of plants.—"The West Australian Settlers' Guide and Farmers' Handbook."

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BEESWAX PREPARING.

Separate the better part of the comb from the brood portion as much as possible when you are draining the honey. When drained, boil the comb in water, stirring frequently to prevent its burning. When completely melted, strain through bags (hair bags are the best) into a tub of cold water. Repeat this operation twice, or even thrice, and through bags increasing in fineness. Finally, melt the wax by itself, and pour into moulds of desired shape, first wetting them. Cool in a warm room until the cakes solidify. This will prevent their cracking in the middle. Another plan, and more simple, is to place the combs in a conical earthenware vessel filled with a mixture of one ounce of nitric acid to a quart of water. Set this upon an open fire and stir until the wax be completely melted, then remove it, and allow it to cool gradually. The product will be in three almost distinct layers ; the upper one will be pure wax, in the middle will be sufficiently good wax to be added to the next melting, or for many household purposes, and the lowest layer will be chiefly impurities.—"Australasian Farmers' Guide."

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HARNESS DRESSING.

The English Government harness dressing is said to be prepared as follows : 1 gallon of neatsfoot oil, 2 lbs. of bayberry tallow, 2 lbs. of beeswax, 2 lbs. of beef tallow. Put the above in a pan over a moderate fire. When thoroughly dissolved, add 2 quarters of castor-oil ; then, while on the fire, stir in 1 oz. of lamp black. Mix well and strain through a fine cloth to remove sediment ; let cool. A composition which not only softens the harness, but blackens it at the same time, is made as follows : put into a glazed pipkin 2 oz. of black resin, place it on a gentle fire ; when melted, add 3 oz. of beeswax ; when this is melted,

take it off the fire, add ½ oz. fine lampblack, and ½ dr. of Prussian blue in a fine powder; stir them so as to be perfectly mixed, and add sufficient spirits of turpentine to form a thin paste; let it cool. To use it, apply a coat with a piece of linen rag pretty evenly all over the harness, then take a soft polishing brush and brush it over, so as to obtain a bright surface. Blacking for harness: Molasses, ½ lb.; lampblack, 1 oz.; yeast, a spoonful; sugar candy, olive oil, gum tragacanth, and isinglass, of each 1 oz., and the gall of an ox. Mix with 2 pints of stale beer, and let it stand before the fire for an hour.—"Trade Secrets."

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PAINTS.

If it is of importance that the paint should dry quickly, and still have a bright appearance, it should be mixed with turpentine, and some gold size added when mixed. If it is wished to make a paint to dry in twenty minutes or half-an-hour, it must be mixed with turpentine, and without oil. When dry this paint will have a very dead, lustreless appearance, and requires a coat of varnish afterwards to make it look as it ought. This is a method very often adopted for iron-work. When about to re-paint old work, all dirt and projecting pieces must be carefully removed, and if the paint appears greasy it should be washed with turpentine. Some times a good washing with weak tea water, made by pouring boiling water on tea leaves that have been already used for making tea, will prove effectual. Whenever pieces of paint have come away through sun blisters, or other causes, the patches must be painted over with a coat of priming. All the effects must be stopped and made good with putty, when the new coat may be applied. Table of compound colours produced by mixing simple colours:—Straw colour: chrome yellow and white lead. Lemon colour: chrome yellow and white lead; more of the first than in straw colour. Orange: chrome yellow and vermilion (bright yellow ochre and red lead (duller). Buff: white lead and yellow ochre. Cream colour: same as for buff, but with more white. Gold colour: chrome yellow, with a little vermilion and white lead; or Naples yellow and realgar. Stone colour: white lead and yellow ochre, with a little burnt or raw umber. Stone colour (grey): white lead and a small quantity of black. Drab: white lead, burnt umber, and a little yellow ochre (warm); white lead raw umber, and a little black (cool). Fresh colour: Lake, white lead, and a little vermilion. Fawn colour: same as for flesh colour, with some ochre instead of lake. Peach colour: white lead, with vermilion, Indian red, or purple brown. White lead: Prussian blue, and a little lake. Olive: black, yellow, and a little blue; or yellow, pink, lampblack, and a little verdigris. Chestnut: light, red and black. Salmon colour: venetian red and white lead Chocolate: black, with Spanish brown, or venetian red. Sage green: Prussian blue, raw umber, and a little ochre, with a little white. Olive green: Raw umber and Prussian blue. Pea green: white lead and Brunswick green; or white lead, Prussian blue, and some chrome yellow. Pearl grey: white lead, with a little black and a little Prussian blue, or indigo. Silver grey: same as for pearl grey.

Grey (common): white lead and a little black. Lead colour: white lead, with black or indigo. Violet : vermilion, white lead and indigo, or black. Purple : Violet, as above, with the addition of a rich dark red, or colours for French grey. French grey : white lead, with Prussian blue and a little lake. Lilac : same as for French grey, but with less white. Oak colour : white lead, with yellow ochre and burnt umber. Mahogany colour : A little black, with purple brown or venetian red.—"The West Australian Settlers' Guide and Farmers' Handbook."

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SORE SHOULDERS.

A correspondent of a contemporary writes:—"I find that the best gall cure for sore shoulders is to remove the cause by opening the face of the collar, and taking out enough of the stuffing to take off all pressure on the sore spot. When this is done, nature will do the rest, unless the sores have been poisoned, in which case surgical treatment will be necessary to effect a cure."

The correspondent is right in saying that the remedy for sore shoulders is the removal of the cause. The fact is that there need be no sore shoulders; their presence nearly always indicates either incompetence or shameful neglect on the part of the teamster. A little care in fitting the collar and the exercise of a little good horse sense will usually prevent any trouble with the horse's shoulders.

One very common defect in collars, and especially old collars, is flatness of face; the stuffing gets worked out of place, and the face of the collar becomes too flat. This throws the pressure too much on the outside and on the point of the shoulder. Very often, too, the collar is too wide, especially at the top. A collar of this sort will swing from one side to another at every step, and will soon gall the shoulder. Sometimes the collar becomes very badly worn at the bottom end, either from the play of the neck-yoke or from some other cause; when this is the cause the collar will roll on the horse's shoulder, and will pinch him very badly; the only satisfactory remedy in this case is a new collar. Very often, too, the fault is not in the collar but in the adjustment of the hames. It is not at all uncommon to see a green hand working horses with hames projecting an inch or two below the collar, bringing the line of draft almost on the point of the shoulder; the inevitable result, if the horse is at all heavily loaded, is sore shoulders. Sometimes, but not so often, the fault is in the other direction, and the line of draft is too high. This is less likely to gall the shoulders, but is more likely to draw the collar up too high against the windpipe and chokes the horse.

Care should be taken that the mane does not get worked in between the collar and the shoulder. Many sore shoulders may be traced to this cause. The mane should be drawn out from under the collar before starting to work, and at intervals during the day. If it is troublesome that portion should be braided out of the way.

The shoulders should be washed clean at night, after the horses have completed their day's work.—"The New Zealand Farmer, Stock and Station Journal."

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TO FIND THE NUMBER OF GALLONS OF WATER RAISED BY A PUMP.

To find the number of gallons or fraction of gallons that will be raised at each stroke of a pump, first ascertain the diameter of the pump cylinder; secondly, the length of stroke. Square the diameter and multiply by the length of stroke, and divide by 353. Thus, if the diameter is three inches : $3 \times 3 = 9$; and the length of the stroke 12 inches, $9 \times 12 = 108$. $108 \div 323 = .3005$, or roughly, 1-3rd of a gallon at each stroke.—"The West Australian Settlers' Guide and Farmers' Handbook."

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HOME-MADE SOAP.

The following, being of general interest to country readers, are quoted from a pamphlet on making soap without boiling, by Mr. W. J. Menzies, Liverpool :—Potash wool-scouring soap : A pure potash wool-scouring soap can best be produced in the following manner : Take a 20 lb. can of pure caustic potash (Greenbank), cut open the lid and put the whole can into an iron or earthenware vessel, with two gallons of water. The potash will soon dissolve out, itself heating the water ; the empty can then being removed, allow the liquid potash (or lye) thus obtained to cool until warm to the hand (say 90° F.). In a large iron pan or boiler melt 80 lbs of tallow, free from salt, until dissolved, and of a heat feeling fairly hot to the hand (say 120° F.). Into the melted tallow now pour the potash lye in a small stream, with constant stirring with a flat wooden stirrer about 3 inches broad, and continue to stir until the mixture is smooth, and appears well combined—a few minutes is all that is necessary. This mixing operation may be done in the melting-pan itself, or often, what is more convenient, an old water-tight barrel can be used. Now pour off the mixture into any convenient square box for a mould, damping the sides with whitewash, or, better still, liming it with a calico cloth, to prevent the soap from sticking. Wrap up the box well with sheepskins (to keep in the heat by the mixture itself turning into soap), put in a warm place, and leave it for four or five days. The box will then be found to contain 120 lbs. of hard potash soap, which if cut up into bars, and kept for a week or two, will be further improved in quality. If the soap has been mixed in a barrel, and required only for sheep-washing or dipping, it can remain in the barrel instead of being poured off. But it must be well wrapped up, and left standing in a warm place for a week or two.—"Australasian Farmer."

TRACTIVE FORCE OF HORSES.

Rate in miles per hour.. ..	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
Tractive force exerted in lbs. ..	166	150	125	104	83	62	41

Force of traction required for carriages of one ton on a level road :—

Description of Road.	Force of Traction per ton.
1. On rails	8 lbs.
2. Well made pavement	33 „
3. Macadamised road ..	44 to 67 „
4. Turnpike, hard and dry	68 „
5. Turnpike, dirty	88 „
6. Hard compact loam	119 „
7. Gravel	150 „
8. Sandy and gravelly..	210 „
9. Ordinary bye-road	237 „
10. Turnpike, newly gravelled	320 „
11. Loose sandy road	457 „

A horse produces his greatest mechanical effect in drawing a load at $2\frac{1}{2}$ miles per hour with a tractive force of 150 lbs.—"The West Australian Settlers' Guide and Farmers' Handbook."

DIARY FOR FARM, FIELD AND ORCHARD.

NOTES ON THE FARM.

By Alex. Holm

(General Manager, Experimental Farm, Potchefstroom).

February.

This is generally the wettest month of the year, and the period is less busy than usual on a farm, both in regard to live stock and to crops.

Live Stock.—The advantages in having stock running in encampments, instead of being confined to kraals during the night, will be obvious during the wet weather, when they will be more comfortable, warmer and drier on the veld.

At this time the second litters of pigs of the season should be dropped. They will then be old enough and strong enough to withstand the cold of the winter months.

In some districts "horse-sickness" and "blue-tongue" in sheep are prevalent. The latter is referred to under notes in January. For the former the preventive measures of inoculation in mules carried out by the Veterinary Division on the investigations of Dr. Theiler must be well known to all readers, and pending a similar discovery applicable to horses, the most rational protective methods to adopt appear to be the good stabling of horses during the time between sunset and sunrise.

Crops.—Little planting or seeding is done during this month. In districts where frosts seldom occur or only occur late in the season, potatoes may be planted. Barley to be cut for green fodder in May and June should be sown early in this month. This crop, sown at this period, is, however, often destroyed by the attacks of "aphides," and may, therefore, be considered risky.

The cleaning operations of summer crops should receive great care during this month when weeds grow apace. The advantages of having crops systematically planted in rows where they can be kept clean by horse and hand hoeing will be apparent.

March.

Live Stock.—Little remains to be added to the notes of previous months. This is a good time to have calves "dropped." They will be practically weaned before milk becomes scarce and valuable, and with a little feeding during the remainder of the winter months they will be strong enough, and old enough, to thrive on the veld during the following summer. Cows calving at this time will also continue to milk during the winter if well fed and cared for.

Crops, etc.—Ploughing for the winter cereal crops under irrigation should be pushed ahead. Late and hardy varieties of wheat and oats should be sown this month. Such varieties which have been tested on the Experimental Farm at Potchefstroom give greater yields than earlier varieties commonly grown in the country. Barley, which is intended to be cut for green fodder in July or August or grown for its grain, may be sown after the middle of the month.

Haymaking should be commenced this month. Notes on this operation appear under April in the April, 1906, issue of this "Journal."

Silage crops will, in some cases, be ready for ensilage this month. An article on this subject in the July, 1906, number of this "Journal" gives full particulars on this subject.

APRIL.

Live Stock.—With the change of the season particular attention should be paid to the health of the stock. Chills may be expected, and if care be taken to treat the symptoms as soon as they appear, frequent losses from pneumonia and other inflammatory diseases may be prevented. Calves born in spring should now be weaned, and, if the grass is not good, give them some extra feeding to prevent them from losing condition and to keep them growing. The castration of the bull calves should be completed early this month before frosts set in. "Spare not the knife" is a good axiom in breeding. Too many males are left to procreate their species. Many a cross-bred animal may be individually a good beast, but a cross-bred male should not be used for service. Let the male, which stamps the character of the herd, be pure bred.

In districts where lambs are desired in September and October, the rams should be placed with the ewes during this month. The gestation period of a ewe is 20 to 21 weeks. Care should be taken to have the ewes in good improving condition, if possible, when the rams are placed with them. A better "crop" of lambs will be secured, and, in certain breeds, the percentage of twins will be greater.

April is a suitable month for dipping; too great importance cannot be attached to proper and systematic dipping for the eradication of scab. The common practice of hand-dressing affected animals is most unsatisfactory, and is not attended with the same good results as dipping. In districts where water is scarce, sheep farmers should endeavour to make arrangements for the storage of a supply of water on their own farms, so that dipping might be carried out more effectually, and with better facilities.

In some districts lameness with intense pain is often caused among sheep by ticks, which generally burrow into the tissues immediately above the hoof, though sometimes they attach themselves further up the leg. Lame sheep of the flock should be examined for this daily, and the ticks should be carefully removed. If the part be inflamed or "festering," apply a little tar, or wash with Jeyes' Fluid or other disinfectant.

Crops.—On cropping farms, especially where irrigation is pursued, this month is a busy one.

The seeding of the winter forage and grain crops will be in full swing, haymaking and ensilage should be completed, and a beginning will be made in the harvesting of the mealie crop.

Winter crops under irrigation should, as far as possible, be sown this month. A braird obtained with the usual autumnal showers is advantageous, and, if the crop becomes well established before the dry winter sets in, less irrigation will be required to bring it to maturity. If practicable, the land should be ploughed in the opposite direction to that in which the water flows in irrigation. The seed bed for winter crops should be carefully prepared with the use of harrows and cultivator. Leave the surface with a loose tilth, not too fine, in order to prevent the soil packing and consolidating on the surface after being irrigated. The use of labour-saving implements, such as reapers and binders, will be greatly facilitated if an even seed bed is prepared.

Barley should be sown early in the month; especially for green forage purposes it should be sown on rich well-manured land. It should be sown at the rate of 100 lbs. to 130 lbs. per acre according to the kind of soil and the character of the seed bed.

Oats should be sown this month; about 120 lbs. per acre is an average seeding. The "Boer," "Cape" and "Algerian" are of good quality for growing oathay.

Hardy varieties of wheat may also be sown this month. Opinions greatly differ as to amount of seed required. Much depends on the tillering properties of the variety sown and the fertility of the soil. If very rich, less seed will be required. To obtain a full crop the writer has found that, in the Western Transvaal, 120 lbs. per acre is not too much.

The prevalence of smut and bunt in the grain crops grown in this country frequently involves serious loss, especially in the wheat crop. A practical method of prevention consists in mixing the grain with a solution of copper sulphate. One pound of this dissolved in 1 gallon of water is sufficient for 1 sack or muid of grain. If it be obtained in the ground form it can be dissolved in cold water. It should be sprinkled over the mass of grain in the proportion stated, and the whole should be turned over two or three times. About six hours afterwards it will be fit for sowing. Other excellent methods of prevention can be used, but often they cannot be conveniently carried out on the farm.

Haymaking.—Grass is too frequently cut for hay when it is too old or has been frosted, both resulting in a deterioration of its feeding qualities. It should be cut when still green, and before the seed has ripened. Haymaking is a simple operation in this climate on account of the abundance of sunshine and the infrequency of rain. As a rule, the grass should be raked together the following day after mowing, and on the next day it should be fit for stacking. If, however, the crop is heavy, the rows of hay which have been raked together may require turning over with a fork. The main object to be secured in

haymaking is to get the moisture in the grass evaporated as quickly as possible while still preserving its greenness.

For home consumption it is advisable to store the hay in stacks instead of baling it direct. Hay improves in palatability by being slightly "sweated" in a stack. The practice of damping hay is to be deprecated. Mouldy hay, as a result, is often found in the interior of the bale. A rectangular stack 10 yards long by 5 yards wide carried up to 9 or 10 feet at the eaves and then "topped" with a sloping roof will be found a convenient size, and will hold about 20 tons of hay. About 15 lbs. of salt per waggon load sprinkled over the stack will be found advantageous.

The making of silage from crops such as maize, sorghums, millets, etc., should be completed this month.

Harvesting Mealies.—Early varieties should be fit for harvesting this month, and later varieties should be so ripe as to be beyond danger of loss from frost. Where an extensive area is under cultivation, labour-saving machinery must be employed unless cheap labour is plentiful. The Americans, who are the most up-to-date in this respect, cut the crop with a binder specially made for the purpose; the sheaves are then passed through a husker and shredder, and, finally, the cobs are "shelled." Shredded maize stalks are a valuable adjunct to the winter fodder for stock. The practice of removing the cobs from the stalks by hand and allowing the latter to remain on the land for consumption by the live stock during the winter season is economical of labour but is wasteful of food material. As stock-breeding and farming systems become more highly systematised, this practice is likely to disappear in favour of cutting down the stalks before they have become deteriorated by exposure to frost and by becoming too old.

Mannas and millets should be ready for harvesting this month. Varieties such as "Boer" mannas make excellent hay, while more robust millets, such as the "African" and "Pearl," make excellent winter forage or silage.

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THE GARDEN.

FEBRUARY.

Vegetables.—Sow beans, beet, borecole, Brussels sprouts, cabbage, cauliflower, carrots, endive, mustard and cress, lettuce, kohl rabi, onion, parsnips, peas, radish, spinach, turnips, and all herbs.

Plant out from seed beds: Cabbage, cauliflower, celery, etc. Plant potatoes. Do not forget to protect the seed beds from the sun, and keep up a good supply of water. See that the ground does not become caked.

Flowers.—Sow carnation, foxglove, polyanthus, columbine, pansy, daisy, verbena, dianthus, snapdragon and penstemon.

These should all be sown in beds or boxes for transplanting in March or April.

Annuals, and some which in this country develop into perennials, may still be sown for late blooming, and for early blooming the following spring, such as phlox, calliopsis, salpiglossis, escholtzia. Transplant violets which have become too thick. Keep off the runners.

Pansies should be sown in a well prepared bed of leaf mould, rotten manure and sand. If leaf mould is not obtainable, see that the soil has plenty of sand in it. If sowing in boxes, shallow ones about six inches deep are best. A layer of stable manure and then the compost pressed fairly firm to within one inch of the top. Sow the seed thinly and cover with about one quarter of an inch or less of sand.

It pays to sow thinly, otherwise the plants are liable to become drawn and weedy before they are ready for their shift into the garden.

Columbine (*Aquilegia*) should be treated in much the same way, except that it may be sown much thicker. If a good strain of this is obtained, few things equal it for grace and beauty, both as a bed and for cut flowers. It should be given a bed to itself if possible, and planted about 18 inches apart. Probably amongst the seedlings, even of a good strain, there will be some which show a very much stronger, heavier type of leaves. If the best type are desired these may be discarded or planted separate. They are the very old type with short tails and do not compare with the later varieties.

Carnation.—It is quite likely that some will find this hard to germinate and grow from seed. The best way is to prepare a small piece of ground in a shady position, breaking it very fine, and adding plenty of sand, then to make small drills about four inches apart and about half an inch deep, sow the seed fairly thick and cover the drills with fine sand.

This is a good time to layer carnations. Any which it is desired to propogate should have a fork pricked in the soil around, and a good layer of sand placed under the growths. Selecting from the lower growths the strongest, make a sloping cut from below to the centre of the stem, take a long hairpin and making an opening in the sand, place the growth in such a position that the cut opens, pin down and press firmly the sand around it. It is usual to trim the leaves of each layer before the operation. It is easy then to distinguish when growth commences. These should be ready to take off in April.

MARCH.

Vegetables.—Sow beet, borecole, broccoli, Brussels sprouts, cabbage, corn salad, mustard and cress, endive, kohl rabi, lettuce, onion, parsnips, peas, radish, spinach, turnip, and all kinds of herbs.

Plant out from seed beds: Broccoli, cabbage, cauliflower, celery, etc.

Flowers.—It is not too late to sow carnations, foxgloves, pansies, penstemons, dianthus, polyanthus, etc., but if sown this month they will have to remain in the boxes until the end of July or early in August.

Polyanthus.—These should be sown in a protected shady spot of well prepared ground. The young plants need a good deal of watching, but once established they are among the prettiest of the old-fashioned spring flowers. They do not succeed if exposed to too much sun, but need to be planted on the south side of the house or other shady spot. The young plants if sown this month will need to be watered during the dry season.

Pansies, penstemons, carnations and foxgloves which were sown in January should now be making good plants, and towards the end of this month and during the next is the best time for planting out, the cooler weather helping them to obtain a good roothold before the winter.

Care should be taken during this month as the end of the rains approaches to dig with a fork all the ground in the garden. The heavy rain settles this down so hard, and as soon as the dry weather approaches this ground cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains entirely cease, it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

In planting small seedlings out, care must be taken to see that some fine soil goes around and amongst the roots, and that the whole is pressed fairly firm. Many young plants are lost by *hanging*, that is, a hole is made with a pointed stick or dibble, and the point going into the ground perhaps two or three inches below the position for the extremity of the roots, there is an air space below, in which, of course, the roots are unable to grow. The dibble is an excellent way of planting, provided proper care is used and the soil has been worked up into a good friable condition. There is no reason why, with care, flowers may be had even on the High Veld practically all the year round, but to do this it is essential to keep the ground loose on top during the winter months, say, from March to October. Daffodils, narcissus, muscari (grape hyacinthe) commence to bloom, even as early as June, but need to become acclimatised before they are a success. Pansies once established continue to bloom most of the year, but need cutting back about April to a small circle, that is all the old growth. The centre is usually a mass of young shoots; if these are left they will soon become a mass of flowers.

April.

In this month you may sow beets, carrots, corn salad, endive, leek, lettuce, onions, parsnip, raddish, turnips, spinach, mustard and cress. Flower seeds: Mignonette, candytuft, stocks, pinks, pansy, daisy and phlox.

Vegetables.—

Beets.—Sow 5 to 6 lbs. to the acre. The soil should be light, sandy loam, well enriched with stable manure, and ploughed and harrowed until very fine. Sow in drills 1 foot to 15 inches apart, and

when well up thin from 4 to 6 inches. The young beets pulled out of the row are excellent used as "greens."

Carrots.—Thin out the crop 5 to 7 inches in the row, and the rows 10 to 14 inches apart. Hoe often and deeply between the rows. The best soil is a light, sandy loam, richly manured and deeply dug. Sow at the rate of 2 lbs. to the acre.

Corn Salad.—Sow and treat in the same manner as lettuce.

Endive.—Cover lightly; when up, thin out to eight inches apart, and water well afterwards, if dry. When the leaves are 6 or 8 inches long, blanch by gathering in the hand and tying together near the top with yarn or bast. This must be done when quite dry, or they will rot. Take up carefully with a ball of earth to each plant, and place together in frame or cellar for use. They must be kept dry, and have plenty of air or they will rot.

Leek.—Sow in drills 6 inches apart and 1 inch deep. Thin out to 1 inch. When about 7 inches high, transplant them in rows 12 inches apart, and as deep as possible, but do not cover the young centre leaves. Water thoroughly, if dry when planted out. Draw earth up to them as they grow; rich soil is required. Take up and store in earth in a cool cellar.

Lettuce.—Always sow thinly and single out 6 to 8 inches apart or the plants will not be strong. Lettuce requires good ground, enriched with thoroughly rotted manure and well pulverised. The after-culture should be close and careful to secure the best results.

Onions.—Sow in rich, sandy soil, in drills 1 foot apart. Thin to 3 or 4 inches, using the rake and hoe frequently to keep down the weeds. The finest onions are produced by sowing the seeds in frames and transplanting the seedlings to the open ground.

Parsnips.—Sow in rich soil in drills 18 inches apart. The ground should be well and deeply dug. Thin to 4 or 6 inches in the rows. Hoe and cultivate often to keep down weeds.

Radish.—Sow in rows 8 to 12 inches apart every week or ten days for a succession. They should be sown in light, rich soil, as a crisp radish cannot be produced in heavy soils. Sow 8 to 10 lbs. to the acre. Radishes should be eaten when quite small; it is a mistake to let them grow too long and too large. This applies particularly to the French breakfast and small turnip-shaped sorts.

Turnip.—Turnips are generally sown broadcast, but much larger crops are obtained by cultivating in drills 18 inches apart, and thinning to 6 inches in the drill. Sow in drills, 1 lb. to the acre; broadcast, 2 to 3 lbs. to the acre.

Spinach.—Sow in drills a foot apart (10 to 12 lbs. to the acre), every two weeks for a succession, and as it grows thin out for use. Keep clear of weeds. Sow the seed of New Zealand (which must be scalded and soaked in hot water before sowing) in hills 3 feet apart each way, three or four seeds in a hill.

Mustard.—Sow all the year round in beds or in rows 1 foot apart, and press the earth well down. One ounce of seed will sow a bed of 3 square yards.

Cress.—Sow thickly in shallow drills every two or three weeks. Watercress is easily raised, and does fairly well in moist situations. Rightly managed, its culture is very profitable.

Flower Seeds.—

Mignonette.—Every garden should have a plentiful supply of mignonette. The seed can be sown at any time, and if successive sowings are made, its fragrant, modest coloured flowers may be gathered nearly all the year round. Sow in pots or boxes and thin or pot off the seedlings to make good plants for bedding out.

Candytuft.—The candytufts are among our best white flowers for edgings, for bedding or massing, for rockeries and for cutting. Several of the varieties are fragrant, and all are profuse in bloom. Sow where they are to bloom, and thin well when the plants grow about an inch. Sow again in a month for later blooming. The soil should be rich and the plants well watered. They make many branches, and if some are pruned away the flowers will be larger.

Stocks.—These splendid plants with their beautiful and fragrant flowers, their long season of lavish bloom, are well adapted to many conditions of culture. Such plants naturally have many uses. They are unsurpassed for bedding, edgings, pot culture, house or conservatory decoration, and for cutting. For bouquets and floral work the double white sorts are especially useful. To secure fine flowers, sow in boxes, transplanting the seedlings when an inch high into other pots or boxes, or into garden beds of deep, rich soil, setting the plants about a foot apart. Transplanting several times in the early stages of growth tends to give them a more dwarf and compact habit. If plants that begin to bloom late are carefully lifted and potted they will flower finely for a considerable period in a place that is tolerably cool and moist. The blossoms are long lasting, and the side shoots, with their succession of flowers, greatly lengthen the season of bloom.

Pinks.—In this large and greatly varied group are some of our most beautiful and best loved flowers, unsurpassable for colour and fragrance. Old plants flower the earliest, but as young ones give the largest and finest flowers, sowings are made every year. Seed can be sown in an open sheltered bed. The seedlings are easily transplanted and should stand 8 to 12 inches apart; dwarf ones about 6 inches. If especially large, brilliant flowers are desired, a bed of well mixed turfy loam, leaf mould and well decayed manure should be prepared for them.

Pansy.—The seed of pansy is sown in a frame, or in rich, moist garden soil from which the plants can be transferred to a box or bed, setting them 2 or 3 inches apart each way. Seeds sown in a cool, moist place and well tended will give good flowering plants. During hot weather the flowers thrive best in a somewhat shaded place, but in almost any situation good pansy seed will give fine flowers.

Phlox.—The annual phloxes are dazzling in effect, particularly so when sown in masses or ribbon beds of contrasting colours. Few flowers are so easy to grow from seed, so pretty and compact in habit,

so quick to bloom, or give such a brilliant display of colour for so little cost and care. There are few desirable colours beyond their range, and if given good soil and plenty of water they furnish a long supply of delicate flowers for cutting. For pot culture, as trailers, and as an undergrowth for tall bare-stemmed plants they are also valuable. In transplanting set the taller kinds about a foot apart; if planted too thickly they suffer from mildew. Cutting away the flowers and seed-pods makes the plants more bushy and compact, and lengthens their blooming time.

* * * *

THE ORCHARD.

FEBRUARY.

Deciduous.—Such fruit as has been spared by hailstorms should now be fetching good prices. This month is usually one of our wettest, and, accordingly, a large growth of weeds is to be looked for. In many cases it has been perhaps out of the question to keep the orchard free from weeds. Where this is the case, advantage should be taken of the first opportunity to plough everything under, thus adding a large quantity of vegetable matter to the soil. This is of the greatest assistance, affording as it does a supply of humus, and assisting in the retention of moisture. So greatly are most soils benefited by this addition that it is advisable, when it has been possible to keep plantations clean, to plant a cover crop for turning under in this way. Where this is the case, it is usual to sow some leguminous plant such as cow peas, velvet beans, vetches, etc., for the purpose. These are allowed to grow until well into the blooming stage, when the plough is put in and the whole turned under. The object in planting legumes in preference to any other special kind of crop is to obtain the nitrogen which is assimilated by this species, thus securing a most valuable (in fact the most expensive to purchase) constituent necessary to complete fertility of the soil. It was at one time intended to conduct the cultivation of the Government Experimental Orchards by allowing the free growth of weeds during the summer months and ploughing them under at the close of the rainy season. Owing, however, to the untidy appearance, and the fact that these orchards are more or less "show" places, it was decided to discontinue the practice. Now the system adopted is clean cultivation with a cover crop, as described, to be turned under when necessary.

Budding of nursery stocks may now be undertaken. The buds lie dormant during the winter months, breaking out in the spring, the resulting young trees being ready for sale in the following July.

It is hoped that the practice of planting deciduous trees during this month will soon be entirely discarded. The right time to plant these is in July and August. Apart from the consideration of obtaining better growth and a more healthy tree, the question of price cuts some figure. Nurserymen cannot afford to plant out trees in

tins or boxes, look after them for six months, and retail them for anything like the same price as when the trees are freshly taken out of the rows in winter.

Citrus, orange, and such like trees may still be planted up to about the middle of the month. Apart from this work there is little to do in most orange groves. This slack time should be taken advantage of to examine the trees closely for scale insects and disease of any kind. As is unfortunately only too well known, the greatest trouble to be feared is foot or collar rot. Attention has so frequently been called to this most destructive enemy of the citrus family that it would seem almost unnecessary to allude to it again. I will only, therefore, briefly state that the greatest precautions should be taken in selecting the trees intended for planting. See that they are budded on rough lemon stocks; they resist the rot better than any other now in use. Care must be taken in the application of water, and do not irrigate in basins round the trunks of the trees. Trim up all the outside branches to admit the free circulation of light and air. These precautions, if observed, will result in a long-lived healthy grove. I will again state that the rough lemon is not an ideal stock, and, before long, it may be expected to be superseded by a better one. At present it answers the purpose; it resists "rot" better than any other.

March.

Deciduous fruits are now almost a thing of the past, and a rest may be taken as far as actual orchard work is concerned. Some late apples and pears may remain, and these should prove good property. They may be kept for some time if stored in a suitable room, dry, cool and well ventilated.

As in previous years, I may mention that anyone having a few sacks of pits of the common yellow peach may find a market for them at 20s. per sack by applying to this Department.

Citrus.—Water may be applied in moderation to early ripening, and more freely to late fruits. Too much water just before ripening, although it may increase the size of the fruit to a certain extent, is of no benefit, but rather a detriment to the quality of the oranges produced. It is far better to grow a good flavoured orange with a moderate amount of juice, than to produce a larger and coarse article such as would result from irrigation just before the ripening period commences.

April.

Deciduous.—There is little work to do now in the deciduous orchard. Advantage may be taken of the slack season to examine all the trees for scale and other insect pests preparatory to getting ready for the winter spraying. Fortunately, few scale insects trouble our deciduous trees, and the work of spraying is less here than in most fruit countries. Still, we get fungus troubles, including curl leaf of the peach, and where this has been present, arrangements should

be made to spray with either the lime, sulphur and salt or the Bordeaux mixture washes. Winter use of either of these acts as a sure preventative against curl leaf the following season. Broken limbs, etc., may be attended to, and any odd jobs, such as mending fences, etc., be taken in hand.

Citrus.—The first fruits of the citrus orchard will now be appearing in the shape of early oranges from Transvaal groves. True, they may be a little sour, but they are oranges after all, and, being early, should command a fair though not as high a price as does late fruit. This is always the case, not only in South Africa, but the world over, the cause being briefly "sourness."

I shall not cease to advocate the planting of both early and late kinds, and especially the latter, the product of which is really of far greater importance than the former. When the time comes for this Colony to export citrus fruits it cannot be borne in mind too prominently that it is not the fruit which will arrive in the markets of the Northern Hemisphere in July, August and September which will prove most profitable, but that which will come to hand in November and December, rich, ripe and sweet, and in time for the Christmas trade when the demand is largest, and good competitors either entirely or almost wholly absent.

Oranges shipped hence during the summer months of Europe must compete with a multitude of deciduous fruits, berries, etc., with the result, in the first place, that the demand will soon be filled, and secondly, that prices must, of necessity, be low.

EDITORIAL NOTES.

The Census Report.

Since the last issue of the "Journal," the results of the Census of April 17th, 1904, have been published, and the rise of the Transvaal as a great State is clearly seen in this monumental Blue-book. The volume weighs upwards of 11 lbs., and measures 13 in. by 15 in. Many large statistical tables and coloured charts have been inserted without folding, which is a decided advantage for purpose of comparison. No one who glances through this notable compilation even in the most casual manner can fail to be struck with the toil which must have been given to its preparation, and the ability which collected, analysed and interpreted an almost overwhelming mass of figures. To the Census Commissioner, Dr. George Turner, and his energetic assistant, we would offer, on behalf of our readers, our cordial congratulations on the successful finish of his arduous task.

The work of enumeration was carried out by 21 supervisors, who had under their direction 2,146 persons, consisting of 428 men belonging to the South African Constabulary, 40 men of the Regular Forces, 290 civilians for the enumeration of Europeans, and 210 civilians for native districts, 1,120 native assistants, 27 Asiatic enumerators and 31 interpreters. In all, including the supervisors, 2,167 persons were employed in the work of enumeration.

Although with so much more pressing work in front of the farming community and the Department at the time of the Census it could hardly be expected that our statistical returns would be satisfactory, the criticisms of the Commissioner should be carefully noted. He states that much of the information required by the special agricultural returns was found to be useless on account of the ignorance of those who filled them in, of omissions, and of a desire to underestimate ; and he found that no amount of correspondence would avail to make them useful.

The total amount of land under cultivation in the Transvaal was returned at 951,802 acres or 1.26 per cent. of the whole area. Of this 485,134 acres, or a little over half of the land utilised was cultivated by Europeans, the remainder, 466,658 acres, by other than Europeans, practically all natives. Strangely enough, in the Cape the cultivated area amounted to 409,644, or 0.23 per cent. of the area of the Cape. In Natal 537,694 acres were under cultivation, or 2.38 per cent. of the whole land. At that date the figures of stock show that there were 52,159 horses in the Transvaal, 44,153 mules, 33,013 donkeys, 553,388 cattle, 846,939 sheep, 949,876 goats, 160,186 pigs, and 573,121 poultry. The total head of live stock was 3,212,835. The live stock table takes into account 90,041 dogs. In the opinion of the Census Commissioner the figures relating to dogs are worthless ; and it would

appear that very many dogs are roaming at will, the ownership of which is claimed by none in order to avoid taxation.

It is not surprising to learn that mealies (maize or Indian corn) is the most important product, as far as quantity is concerned, but we can hardly point with credit to the fact that it is necessary to import nearly one-quarter of the maize used in the Transvaal. The best wheat-growing district is apparently Potchefstroom, which shows 22.29 per cent. of the Transvaal production : whilst Zoutpansberg is the largest grower of mealies, with 28.73 per cent. The Northern Territory is also first in the production of Kaffir corn, with 38.46 per cent. With respect to all other grain Pretoria town and district are best, with 25.91 per cent. Under the head of forage Pretoria town and district produce 21.28 per cent., and Potchefstroom 20.26 of the Colony's oat hay. The maize grown by Europeans during the year 1904 was estimated at 670,727 muid sacks (203 lbs.), and that grown by all other races at 1,307,296 bags.

It is interesting to learn that at that time there were 69 grain mills in the Colony, of which 46 were driven by steam and 12 by water-power. These mills ground 179,043 bushels of wheat and 1,855,691 bushels of other grain, producing 3,203 tons of flour and Boer meal. It is probable that this number is now considerably exceeded. Apparently, the baking industry is confined exclusively to urban areas, and principally to towns of some size. Home-made bread is generally used and preferred in South Africa, and the Transvaal population is more conservative than any other in this respect ; and there are only 82 places of business in this sub-class. Such is a brief summary of some of the more important statistics respecting agriculture.

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Locust Destruction.

During the past quarter the Division of Entomology has been chiefly engaged in an arduous campaign against locusts, and it will be of interest to review what has been accomplished. At the outset it may be stated that from the experience of old residents in South Africa, as well as that of the Entomologist, it was known that the eggs of the locust would not hatch out until after the first heavy rain has fallen. In the Transvaal, at least, it is safe to expect such rain sometime shortly after October 1st, and on such assumption the late Mr. Simpson and his assistants travelled through the infested areas, giving lectures on locusts and locust destruction, and made all arrangements for the coming campaign. Supplies of the arsenical spray, spray-pumps and all necessary materials were sent in anticipation all over the country to our farmers, and the locust officers who were appointed to the different districts were warned to be in readiness to start work early in October. In addition to these, a large number of secondary officials known as district and sub-district officers, were placed on duty in the various parts of the country, and a number of other officials were put to work with native help to destroy the locust on the Crown lands and native locations.

The field of operations was vast, the swarms to be destroyed were multitudinous, and in many instances covering a large area, one recently reported from the Zoutpansberg district being seven miles long and a mile broad. Never before in the history of the white man in this country have locusts been so bad, and practically the whole of the Transvaal, with the exception of the South-Eastern district, lying between the Delagoa Bay line and the Vaal River, was badly infested.

Numerous swarms have been destroyed, from the north-eastern portion of the Zoutpansberg to the south-eastern corner of Bloemhof. The magistrates in all magisterial districts of the country took an active interest in the matter, the Native Affairs Department called out the natives to assist, and the farmers, with rare exceptions, put in splendid efforts in stamping out the pest. The arsenical spray used by the Department is composed of arsenite of soda, sugar, and water, in different strengths, according to the age of the particular swarm of locusts to be destroyed.

In the destruction of voetgangers by spraying there are two solutions which may be used with good results.

Soap.—Special kinds of soap have been recommended for this purpose, but practically any soap will serve. The solution used consists of one pound of soap dissolved in from three to five gallons of water. In order to be effective the solution must be sprayed actually upon the locusts, as it kills them by stopping up their breathing holes. After extended tests it is found that this solution is effective against voetgangers only when they are young; when half-grown, or larger, the soap kills so few of them that it is practically of no avail. On this account the use of this solution is very limited.

Arsenical Solution.—For the preparation of this solution arsenite of soda, which is readily soluble in cold water, is used. The formula to be used against voetgangers when they are young is as follows :—

Arsenite of Soda ..	1 pound.	(One beef tin or one large cup full).
Sugar	2 pounds.	(Two beef tins full or two cups full).
Water	16 gallons.	(Or four paraffin tins full).

As the voetgangers grow, this solution should be strengthened by reducing the quantity of water. When they are about half grown, the following solution should be used :—

Arsenite of Soda ..	1 pound.	(One beef tin or one large cup full).
Sugar	$1\frac{1}{2}$ pounds.	($1\frac{1}{2}$ beef tins full or $1\frac{1}{2}$ cups full).
Water	12 gallons.	(Or three paraffin tins full).

When the voetgangers are about full grown the following should be used :—

Arsenite of Soda ..	1 pound.	(One beef tin or one large cup full).
Sugar	1 pound.	(One beef tin full or one cup full).
Water	8 gallons.	(Or two paraffin tins full).

Under no circumstances should anyone use a solution stronger than one pound of arsenite to eight gallons of water.

This solution is sprayed lightly upon the grass, in a fine mist, which is quite different from drenching the grass like rain. The voetgangers are killed by eating the poisoned grass. If the voetgangers are small, the solution may be sprayed on and among them, or in a circle around them, but if they are larger, and trekking across the veld, the best method is to spray a strip of grass in front of them, and when they come to it they begin eating, and within from two to eight hours they are practically all destroyed. The success obtained, both in Natal and the Transvaal, by spraying with this solution, has clearly shown that this is by far the most effective measure that can be used against voetgangers.

Arsenite of soda is a deadly poison, and great care should be taken to prevent accidents. All tins or other vessels containing arsenite should always be marked with the word "poison," and the arsenite should always be kept under lock and key. Under no circumstances is arsenite to be placed in the hands of either natives or Asiatics.

The Department had 16 tons of arsenite to begin this season with, and later obtained a further two tons to meet emergencies, which has been sent out to the districts, and, in addition, twenty tons of sugar for free distribution to the farmers. Next year, so as to be able to cope with any work that may arise, and to take in hand extended operations for the eradication of the pest, thirty tons of the arsenite will be stocked for free distribution. A point worthy of note is that the locust officers have been mainly selected from old and respected farmers in each district.

Two-thirds of the Transvaal were more or less infested with brown voetgangers, and at least two-thirds of these have been destroyed by farmers with the assistance of the Division of Entomology. There were, of course, some regions where it was impossible to cope with the pest on account of the lack of inhabitants, and the want of water. It is mostly in these regions that the voetgangers have obtained their wings, and are now flying over the Colony in a general south-westerly direction. There were probably more than a thousand farms infested, and in the Zoutpansberg district alone more than three or four thousand swarms have been destroyed. In the Pretoria district it is estimated that the Division destroyed over 1,500 swarms. As a total probably 12,000 swarms of brown locusts destroyed would be a very moderate estimate. The farmers have taken up with the matter very heartily, and next year we believe will do much better work than was done this season, for there will undoubtedly be as great an infestation next season as there was this.

We are just commencing the work in the Eastern Transvaal with the red locusts, but the infestation is very local, and we do not anticipate a very large campaign there. Unfortunately, however, the red locust has travelled further than usual this year, and deposited its eggs in parts of the regions infested by the brown locusts, consequently the eastern parts of the Zoutpansberg and the Lydenburg district are having a slight campaign against the red locust as well as the brown.

It is gratifying to find that several parasites and diseases are taking off these winged locusts, and they are materially assisting us in destroying the pests. We do not anticipate much damage from these brown locusts which are now flying over the Colony, as they do not stay very long in one place, but fly more or less directly towards the Kalahari Desert.

It will be remembered that last August a conference of representatives from all the British Colonies in South Africa was held to discuss some scheme for gathering information regarding the movements of locust swarms throughout South Africa as a whole. This Congress resulted in the formation of an Inter-Colonial Locust Bureau, established at Pretoria as the most central place. The duties of this bureau are to receive reports regarding locusts sent in from all Colonies subscribing to the support of the Bureau. This data is recorded and tabulated, and weekly or monthly reports, as necessity demands, are sent out to each State, showing the exact position and status of the locusts throughout the whole of South Africa. In this way one Colony can be warned of invading swarms from a sister Colony, and the farmer can thus be prepared to deal promptly and effectively with the pest. From these reports a forecast can be made by each State as to where the locusts will lay their eggs ; and the farmers are thus prepared to destroy the voetgangers as soon as they hatch out, viz., in the stage when they can most easily be killed. A short time ago the Governor-General of Portuguese East Africa was approached to join in this work ; and already we are receiving reports from the officials of that territory with their usual courtesy and commendable promptitude. The Entomologist has now in course of preparation a leaflet setting forth the purposes of this bureau, and the methods of locust destruction, which will be translated into Dutch and Portuguese, and widely distributed throughout South Africa.

We are sometimes asked why the Division of Entomology has adopted the arsenical spray in preference to the screen and pit method adopted in other countries. The answer is that the past experience of the several States of South Africa—notably Natal—has shown that it is the most effective as well as the simplest scheme of destruction in vogue. The screen and pit methods call for such a heavy cost in transportation and labour as to make them more or less impracticable. Moreover, the experience of the Department during the last two locust campaigns has clearly demonstrated the superiority of the arsenical treatment over the various other methods which have been tried in the Transvaal. Further, it is occasionally urged that the practice successfully adopted in the Island of Cyprus, namely the digging up and destroying of the locust eggs, might be done with equal success in this Colony. But in reply we need only point out that Cyprus comprises an area of 3,584 square miles, or about the size of the district of Marico, and has a population of 66 to the square mile, while the magnificent spaces of the Kalahari Desert and the Bush Veld would prevent the putting into practice of such a scheme. But it must always be a matter of gratification to the people of South Africa that the most

practical method yet devised in dealing with this pest was first discovered and applied in their own country, and it is becoming more and more evident that the arsenical spray is the weapon which will ultimately drive away this plague and restore to South Africa the years that the locust hath eaten.

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Veterinary Science.

During the month of September three Government Veterinary Surgeons and six Stock Inspectors were engaged testing the equines of the Johannesburg Municipality, with the view of stamping out glanders. This work was brought to a close during the following month, and the outbreak, which was of a somewhat serious character, may now be regarded as closed.

In the month of October swine fever made its appearance in an epidemic form in the Witwatersrand, which was consequently declared by Government Notice to be an infected area. The disease has now subsided, and the early removal of the quarantine is anticipated.

Scab is still very prevalent, and the recent drought and scarcity of grazing in the south-western portion of the Colony lead us to fear that the disease will not be brought under control for some time. All sheep breeding districts, however, are in favour of compulsory dipping in March and April, and a Government Notice directing this has already been inserted in the *Gazette* in order that the farmers may make timely preparations for dipping their animals.

The position in regard to East Coast fever continues to be hopeful. The disease now shows but little tendency to spread, save in the Zoutpansberg district, where its extension may be attributed to the illicit movement of mature stock. No active centre of disease now exists in the district of Pretoria ; and Pretoria town has now been taken out of quarantine and thrown open to ox-transport after a period of close on three years. The Colony continues to be remarkably free from lung sickness, only two outbreaks of this disease having been reported within the past three months. In other respects the health of the Transvaal stock may be regarded as satisfactory.

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Tobacco Growing Association.

It will be of interest to our readers to know that the Transvaal Tobacco Growing Association continues to make progress. The work of the Association, in so far as the Rustenburg district is concerned, is likely during the early months of the year to materialize in a manner very advantageous to the farmers of this region. We refer to the establishment of a Co-operative Tobacco Factory on practical lines, and we are in a position to state that the details of this scheme are now under consideration. It is worth mentioning that it is hoped to make a special tobacco exhibit in connection with the forthcoming show on the Rand in April. The importance of this to farmers will become plain when it is remembered that most of the tobacco manufacturers of the Transvaal will probably

take advantage of the opportunity offered for examining the various types of leaf produced in the Transvaal; and we would advise our farmers to get into early communication with Capt. C. H. Madge, P.O. Box 405, Pretoria, who, we understand, is taking an active interest in this matter, and will be glad to give further information.

Recently, a timely Circular was issued to the various members of the Association by the organising secretary with the request that it should be returned at the end of the season, together with a few samples of leaf, to Mr. J. van Leenhoff, chief of the Tobacco Division, Department of Agriculture, Pretoria.

It is of the greatest importance to our work of developing the tobacco-growing industry of the Transvaal that we should study the leaf at present grown, and the methods by which it is grown, so that it can be determined what types of tobacco will prove the most marketable and the most profitable to grow. For this reason we hope that all tobacco growers will fill up and return the above-mentioned circular as promptly as possible.

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The Potchefstroom Sale of Stock.

The second annual sale of pure bred cattle, sheep and pigs belonging to the Department of Agriculture took place at the Potchefstroom Experimental Farm on Saturday, November 10th. Early in the morning a heavy rain set in and continued at intervals throughout the morning. Although at first it appeared as if it would adversely affect the sale, none but smiling faces were to be seen, and everyone was delighted at the prospect of a downpour. It was indeed a farmer's day. The large number of farmers, stock breeders and others more or less interested in agriculture who turned up at the Experimental Farm on the most dismal day of the year is indeed a gratifying indication of the importance which the annual sale of Government stock has already assumed. And not only was the immediate farming population around Potchefstroom strongly represented, but people from the more remoter parts of the Colony were also present. It is safe to say that the certainty of a thorough wetting did not deter a single genuine buyer from the sale. His Excellency the High Commissioner set the best example. Through the pouring rain of the morning he spent his time on horseback in company with the General Manager (Mr. A. Holm), visiting all parts of the farm.

The morning was spent by the visitors inspecting the stock for sale, and also, as far as possible, visiting the various sections of the farm. By noon over 300 people had assembled, many farmers having come long distances from the neighbouring Colonies.

Amongst the visitors who sat down to lunch were many prominent citizens and various officials connected with the Department of Agriculture.

Bidding was brisk throughout the entire sale, and it was apparent that a large number of those present had gone to the sale for the object

of purchasing. The prices realised were eminently satisfactory, and on an average much higher than those obtained at last year's sale. The purchasers hailed from all parts of the Colony, and the stock will, in consequence, be well distributed.

The following is a summary of the prices paid.

Under Departmental Notices we publish a fuller list of the buyers and the prices paid, for the information of our readers.

SUMMARY.

	Average Price. £	s.	d.	Total. £	s.	d.
Cattle.						
2 Bulls, imported	45	13	6	91	7	0
15 Bulls, bred on farm	42	11	2	638	8	0
3 Cows, imported	24	17	0	74	11	0
Sheep.						
20 Suffolk and Shropshire Rams, bred on farm	14	12	5	292	8	6
12 Merino Rams, imported	24	3	0	289	16	0
5 Persian Rams	3	4	9	16	4	0
2 Persian Ewes, with lambs	2	2	0	4	4	0
Pigs.						
13 Sows, imported	10	3	1	132	6	0
17 Sows, bred on farm	4	12	0	78	4	6
8 Boars, bred on farm	3	18	9	31	10	0
				£1,648	19	0

After luncheon His Excellency spoke as follows :—Dr. Jameson, ladies and gentlemen,—My friend Mr. Nicholson is very kindly going to give you a Dutch version of what I say. Now, I am always particularly pleased when I have the advantage of being interpreted by Mr. Nicholson, because he not only repeats my speech very accurately, but he invariably improves upon it. (Laughter.) Gentlemen, we are met here to-day on a very interesting occasion. You have seen something to-day of your farm—your farm at Potchefstroom. What we have seen is only a commencement, but I do wish to take this opportunity of congratulating the Commissioner of Lands, the Director of Agriculture, Mr. Holm, Mr. Maxwell Lyte, and all those who have worked with them, on what they have done. Gentlemen, I think they deserve your confidence, and your presence here to-day is the best testimony you could give to that fact. (Hear, hear.) I wish on this occasion to make two observations. The first is about the farmer of the Transvaal, and the next is about the sphere of Government in agriculture. Now, gentlemen, I have said more than once that the country is all right and the people are all right, and I believe it. But what I want to bring home to the farmer of the Transvaal is the fact

that he has got a very serious struggle with agriculture before him. (Hear, hear.) Gentlemen, we all know the great drawbacks caused to the farmer by the war, by disease, by locusts, and by droughts. What I want the Transvaal farmer to realise is the fact that these evils have only accentuated and brought more speedily home to him the difficulties which would have confronted him if there had been no war, no disease, no locusts, and no drought.

The Turning Point.

The farmer of the Transvaal is at a turning point in the history of agriculture in the Transvaal, and the real reason for that is neither war, nor disease, nor drought, but the fact that he is now for the first time brought from a position of isolation into competition with the whole world. (Hear, hear.) When there were no markets available to him in South Africa, and when there were no railways, he was necessarily isolated. He could live, and live very comfortably and happily, on his farm. But he was able to prosper largely owing to the qualities of the country, and to the bounty of produce. He could watch his flocks and his herds increase, and there was no incentive to him to special exertion, because there were no markets to which he could send his produce. But now, with the creation of large markets in South Africa, with a railway system which is bringing him more and more into touch with the outside world, he is being brought for the first time in his history into competition with the farmers of the whole of the rest of the world. And that is the real cause of his difficulties. Protection up to a certain point can do a good deal for him, but no protection can save the farmer of the Transvaal from the competition of the farmer of Europe and America, or of Australia, unless the farmer of the Transvaal proves himself to be as good a farmer as the farmers of Europe, of Australia, or of America. (Applause.) That is my first point.

What of the Future?

The future of agriculture rests on the farmer himself. Providence has given him as fine a body physically, and as fine a mind mentally, intellectually, as the farmer of any other civilised country. The whole question is whether he is going to use those physical and intellectual powers in the way that the farmers of the rest of the world have had to use them. I said it in Pretoria—I say it again here before you all—that, up to now, the Transvaal farmer on the average has not had to work nearly as hard as the European or the American or the Australian farmer, and he has got to do it. (Hear, hear.) He has got to do it—that is the first thing. He has got to devote the whole of his physical and mental strength to his work as a farmer, and he must not sit down and think that he knows all that is necessary for a South African farmer to know. He knows, of course, a great deal more about the particular and peculiar conditions of South Africa than a farmer does who comes out here from elsewhere for the first time. But there is no farmer in the whole world who can afford to sit down and say, "I know all that

can be known." (Hear, hear.) The South African farmer has got to grapple with all those problems of stock and crops which farmers in other parts of the world have had to grapple with, and unless he realises that and turns the whole of the gifts with which Nature has endowed him to the problem of learning more about his business of producing more from his farm and more of a better quality, no matter what protection he has he will be beaten by the farmer from the rest of the world. That is my first point.

The Government's Duty.

My second point is : What can the Government of the country do for agriculture? Now, this is the last time I shall probably address a meeting of farmers when I myself am personally responsible for the part the Government takes in fostering agriculture. Within a few weeks the direct responsibility on that subject will rest with the Ministers of your own elected Government. Do not think for a moment that, because I cease to be personally responsible, my interest in it will slacken for a moment. (Applause.) On the contrary, none of my duties will give me greater pleasure than assisting in any way I can the Responsible Ministers of the Transvaal in their agricultural work, and in addition I shall have that privilege which has been enjoyed, and is enjoyed to such a large extent by the people of the Transvaal, of criticising what the Government does. (Laughter.) But what I want to tell you farmers is that it is your business to keep your own Government up to the mark in this matter. (Hear, hear.) And I want you to believe me when I say that the sphere of influence the Government can have on agriculture, if properly directed, may be very large. I do not mean simply grants of money to agricultural associations. Do not think I want to take away from Mr. Nicholson the grant which he thinks is all too exiguous. But the sphere of help by a Government can be far more important than merely grants to associations. You see something of it here on this farm ; but I hope this farm is only the beginning of a far greater work—the beginning of an agricultural college, where the sons of farmers, intending themselves to be farmers, can go and learn all that can be learnt from experiment and from science to supplement their native knowledge.

Science the Necessity.

Because more and more the farmer must realise that science is necessary in the promotion of agriculture. You have had a wonderful example of it here in the Transvaal. What but science carried out by assiduous labour over a continuous period of time has resulted in the immunisation of mules from horse-sickness? And what will you say when horses are immunised too? Just think of the immense assistance to the farmer, which he never could have done for himself, but which could be done by continuous and sustained work in a Government institution by trained scientists. But that is only one instance. Take Canada, one of the greatest agricultural countries in the world, where

the Government are spending great sums of money every year for one purpose only, and that is to try and produce wheat that is immune from rust. Just think of the result to the Transvaal if you could find a wheat which was not a winter wheat where irrigation was necessary, but a wheat which you could sow in the spring, which would ripen in the summer, and would stand the effect of the summer rains and not rot. Only the other day I read of an extraordinary instance of the result of science in the United States of America, where, after a long series of experiments, one of their scientists has absolutely bred away all the prickles from the prickly-pear. He now has produced a prickly-pear that has no prickles—(laughter)—that will grow in the most arid and dry portions of the United States, and will render all those vast districts splendid countries for cattle, because this particular pear, I am told, is excellent feeding for stock.

The Ignorant Critic.

I only give this as an instance of the way in which science properly and continuously directed—that is the point—can help agriculture. And the temptation of a Parliament is this : A member gets up and he says : "Here is a vote for experimental agriculture. What have they produced? Why, they have been at work for five years and they have given us no new animal and no new plant. I protest against this waste of public money." You can only really help agriculture through science if you insist on your Government putting down a sufficient sum of money every year, and sticking to it. (Hear, hear.) Do not let your votes be promiscuous and sporadic. It takes the heart out of a man of science like Dr. Theiler if, just at the moment when he knows he is coming to the fruit of years of experiments, an ignorant critic gets his vote reduced, clips his wings, takes away the weapons out of his hand, and all the money you have previously spent has been wasted. Because many experiments are fruitless, do not despair. You cannot expect every experiment to produce equally good results. You will be amply rewarded if, in every generation, one great experiment or one great invention results. Take the question of the immunisation of mules and horses. Why! If that really comes about with the horses as it has come about with the mules—and will, I verily believe with horses—it is worth years and years of public money voted to this purpose. (Hear, hear.) And you must have patience, and you must have faith, and you must have persistence in a policy. There is no fault of popular Government more serious than want of consistency in a policy. And that is where the farmers of the Transvaal—if they understand what is really required to help them—that is where they can bring an overwhelming influence to bear on their members, to insist on the Department of Agriculture being properly supported and properly supplied with public funds. (Hear, hear.) You have the example of the most progressive nations of the world before you. The sums that are spent in the United States of America on experimental agriculture are enormous. If you ask Mr. Smith, the Director of Agriculture, he will give you the figures, but I know that here they would seem to us quite

colossal sums. And if practical people like the Americans think it worth their while to spend money on that scale you may be quite sure it is worth your while to spend money suitable to your possibilities. (Hear, hear.) Gentlemen, I have done. I have made the two observations I wanted to make, and I have made them with confidence, because I believe them to be true. Let the Transvaal farmers develop to the utmost his own powers, and let him keep his own Government up to the mark in assisting with the power of the State, the work of the individual farmer. (Applause.)

* * * *

Cotton on the Tzaneen Experimental Farm.

Mr. H. S. Altenroxel, Manager of the Tzaneen Experimental Farm, has sent in the following interesting report :—

The season 1904-5 was an exceptionally dry one, and the cotton suffered severely from drought. This, however, was most valuable, as it proved that the cotton will yield, even with only about one-half the ordinary rainfall, a satisfactory crop. The average yield for the season was about 320 lbs. of lint per acre.

Sea Island cotton ought to be sown from the 1st to the 15th November, and the Upland and Egyptian varieties from the 15th November to 1st December. The climate seems to suit cotton well, because we have about 5 to 6 months rain for the full development of the plant, and afterwards dry weather when the bolls begin to open and ripen.

I have found that we must not plant the cotton on our best soils, because on these the plant grows too big, and the production of lint is not in proportion to the size of the plant. I have grown it on different soils, and find that the medium loams are the most suitable. Absorbent soils are the best, but must be well drained. No manuring took place. The cotton on plots that had been two years under cultivation (tobacco and maize) did better than on newly broken lands. Cotton will produce several crops on lands where maize has ceased to grow satisfactorily. As regards the chemical properties of soils for cotton, it may be said that if they contain less than 0.05 per cent. of potash, phosphoric acid and lime, they may be considered seriously deficient in available plant food elements. In good soils the normal proportion of nitrogen is about 0.01 per cent. The distance between the rows should be 4 feet, except on sandy and poorer soils, where 3½ feet will do. In the rows the plants should stand about 12 inches apart. According to the variety of soil the distance in the rows vary a little. Two to four seeds must be planted, about one inch deep, at the desired intervals, and the weaker plants removed later, one only being left.

Horse-hoeing was freely practised after the plants were well above ground, gradually working the soil up against the plants. The hand-hoe was applied twice near the plants, and the weeds pulled out. When the cotton had reached the fruiting stage, cultivation ceased. The period of growth was very irregular on account of dry weather lasting sometimes for months. Picking was started five months after

planting, and lasted from four to five months. With the exception of some small caterpillars, no insects troubled the plants.

Native boys, women and children are employed in the picking, and I am glad to say they take well to this tedious work. At first, of course, the performance was slow, and less than 40 lbs. per head per day was averaged. Women and children are the best for picking, but it will require a good deal more practice before our natives can pick 100 lbs. per head per diem.

A most satisfactory report on the samples sent to England was received from the British Cotton Growing Association, to whom it was forwarded by Professor W. R. Dunstan, of the Imperial Institute, London.

From my observations during the past season, when the under-mentioned varieties were planted, I formed the following conclusions :

King's Improved.—Germinated badly, short bushy plants, not a heavy cropper, and very irregular blooming.

Hawkin's Improved.—Germinated well, average height 4 feet, good cropper, appears to be hardy, but bolls are small. Comes to maturity fairly evenly.

Allen's Silk Long Staple.—Germinated well and regularly, average height 4 ft. 6 in. Very prolific, bolls evenly and numerously. Appears to be well suited to the soil, and hardy. Fairly long staple, but stains from seed.

Cook's Long Staple.—Heavy cropper. Germinated well, average height 5 ft. Sturdier and stronger in growth than Shine's Early Prolific. Bolls burst evenly and numerously, therefore requires fewer pickings. Long staple.

Shine's Early Prolific.—Germinated well, average height 4ft. 6 in., very prolific, bolls rather small, but open numerously, comes to maturity fairly early. Good staple.

Abassi Egyptian.—Very irregular germination, tall and very straggly in growth. Blooms profusely, but bolls do not arrive at maturity. May do better if planted very early under favourable conditions. Appears to be affected by cold weather more than other varieties.

Bohemian.—Germinated well and regularly. Hardy and sturdy, average height 4 ft. 6 in. Fairly heavy cropper. Fine staple. Early planting advisable.

Upland Big Boll.—Germinated well; nice sturdy, healthy plants, but cotton appears to be very straggly, and does not appear to be a heavy cropper.

Excelsior.—Germinated fairly; short weedy looking plants. Bolls fairly numerous, but small.

Peterkin.—Germinated well. Fine lusty plants of average height of 4 ft. 6 in. Good cropper, with fair sized bolls. Short staple. Early planting advisable.

I firmly believe that there is a great future for cotton growing in the northern Transvaal, where native labour is fairly plentiful and cheap. The women pick about 35 to 40 lbs. per day at an average cost of 6d.

Arrangements have been made whereby the farmers in the district who grow cotton may bring in their seed cotton to the factory to be ginned. They are paid spot cash, approximately two-thirds of the value of the lint; it is then baled, shipped and sold in England, and the balance is paid on receipt of the proceeds of the sale.

Seed of the most successful varieties is being distributed free to farmers, who, I believe, will plant a considerable acreage during the ensuing season.

I propose to increase the acreage of cotton on Tzaneen Estate, and have no doubt that the district will follow suit, and that, with reasonable railway rates, the industry will become prominent in the near future.

It is worthy of note that in connection with the South African Products Exhibition the Department of Agriculture has forwarded to London 27 bales (totalling about 3,000 lbs.) of cotton, the first actual export of cotton from the Transvaal.

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Irrigation and Arid Experimental Farms.

In this issue there will be found a plea for the establishment of an Experimental Irrigation Station and also an Arid Experimental Farm for the Transvaal. There are surely few men in this Colony who would care to deny the immense value of practical instruction in modern methods of irrigation, and certainly none who do not fully realise that there is still much to be learned locally regarding the tillage of the soil for the conservation of moisture. But, as both writers naturally see the special merits of the one or the other scheme, it would be interesting to find out from our readers which they consider the most needful at the present moment. At the same time, it may be worth mentioning that the State of Utah not only possesses five Arid Experimental Farms, but also an Irrigation Experimental Station at Logan—all of which are under the direction of the State Agricultural College.

* * * *

Poultry.

Poultry matters are steadily forging ahead in the Transvaal, but this branch of agriculture has not, as yet, been taken up as it deserves.

The Transvaal Poultry Club has arranged a laying competition, and they have the promise of support from the Agricultural Department.

It is intended to provide for a twelve months' competition for 48 pens of four pullets each. Naturally, such an undertaking means a good deal of expense, and will require to be carefully considered.

The South African Poultry Association also intend arranging for a laying competition in the near future, and this will be thrown open to the whole of South Africa.

Several new Clubs have been started in the Transvaal, but we would like to see the bulk of the people in this country, and more particularly our farmer friends, taking up this subject more seriously. There is absolutely no doubt that it will pay handsomely. At the present moment millions of eggs are imported into the Transvaal from Europe and the Coast Colonies. These eggs are readily bought for from 1s. 9d. to 2s. per dozen, with the risk of getting stale. All these eggs could be produced in this Colony and marketed, say, within three days from the time they are layed. The public would then know that they get fresh reliable eggs and would willingly pay a higher price than they are now paying for the imported article, which, at the best, is unreliable.

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Forestry.

Mr. C. E. Legat, Conservator of Forests, writes as follows:—

"Early in March, 1906, some samples of the coagulated and uncoagulated latex of an Euphorbiaceous tree were received from Mr. A. C. van Maarseveen, of Piet Potgietersrust, who wished to be informed if they contained rubber and were of any commercial value. The samples were sent Home to the Imperial Institute for examination and valuation, and the following report has lately been received in regard to them":—

Report on Euphorbia latex from the Transvaal by Professor Wyndham R. Dunstan, M.A., F.R.S., Director, Imperial Institute, S. Kensington, London, S.W.

Samples of the coagulated and uncoagulated latex of an Euphorbiaceous plant growing in the warmer parts of the Transvaal were forwarded for examination to the Imperial Institute by the Acting Director of Agriculture at Pretoria with letter No. 7331, dated 21st March, 1906. It had been suggested that the Transvaal tree is identical with the species of Euphorbia which yields the "Intisy" rubber of Madagascar, and it was consequently desired to ascertain whether the product is of commercial value.

It was also stated in the covering letter that specimens of the plant had been sent to Kew for identification. It was ascertained, however, on enquiry from the Director of the Gardens that it had *not* been possible to determine accurately the identity of the tree from the material forwarded. The plant may be a species of Euphorbia allied to *Euphorbia mauritanica* and *Euphorbia Tirucalli*, but distinct from both. It may be mentioned that the "Intisy" rubber of Madagascar is derived from a species of Euphorbia which has been described as *Euphorbia Intisy*.

COAGULATED PRODUCT.

The samples of the coagulated latex consisted of three large lumps, one of which was labelled: "Found and prepared by A. C. van Maarseveen, of Potgietersrust; mixed with a few drops of sour lemon

juice and boiled until coagulated. Fairly clean. 27/2/06." This sample weighed 430 grams. It is referred to below in the table of analyses as Sample A.

The two other pieces were unlabelled and, together, weighed one kilogram. They were identical in appearance, and were treated as one sample, referred to as B in the analytical results.

The material was hard, and was evidently of resinous character; it had a slight yellow colour and possessed a disagreeable odour. In appearance it resembles the product known as "Almaidina," which is obtained in West Africa from a species of Euphorbia usually described as *Euphorbia rhipzaloides*, Welw.

The chemical examination gave the following percentage results:

	Samples as received.		Calculated for dry material.	
	A.	B.	A.	B.
Moisture	28.9	27.9	—	—
Resin	53.8	54.6	78.5	75.7
"Caoutchouc" ..	13.8	15.0	19.4	20.8
Albuminoid matter ..	0.5	0.4	0.7	0.6
Vegetable impurity ..	1.0	2.1	1.4	2.9
Ash	2.33	2.30	3.28	3.19

These results show that the product is of very resinous character, the dry material in each case containing over 75% of resin. The substance returned as "caoutchouc" was, moreover, totally unlike true rubber in properties, and, on drying, it became quite friable.

In composition, as in appearance, the material resembles "Almeidina."

Latex.

The two samples of latex were labelled 1 and 2. Sample 1 consisted of 300 c.c. of a thin yellowish-white latex, and was stated to have been obtained from a single tree in three-quarters of an hour. Sample 2 consisted of the same quantity of similar latex which was obtained from two younger trees than that which yielded No. 1. The quantity of latex represented, it was said, about three-fourths of that obtained in half-an-hour.

Both latices were readily coagulated in the cold by the addition of a little alcohol. The addition of acids had little influence until the latex was warmed, when coagulation occurred immediately if a dilute mineral acid was used, and slowly in the case of acetic or citric acids. The solid products prepared by these methods were exactly similar to the samples sent from the Transvaal.

Latex No. 1 furnished about 34% of dry coagulum, whereas the yield from No. 2 was almost 50%.

Analyses of the dry coagulated products gave the following percentage results:—

	1	2
Resin	85.0	92.8
"Caoutchouc"	14.4	6.7
Albuminoid matter	0.6	0.3
Ash	—	0.2

The product prepared from latex No. 1 corresponds generally in composition with the coagulated material sent from the Transvaal, but contains a little more resin. The other sample, 2, yielded a still more resinous product, but this is, no doubt, explained by the fact that the latex was obtained from young trees in which, as a rule, the percentage of resin is higher than in older plants.

Commercial Valuation.

Samples of the solid material were submitted for valuation to brokers, who described it as "Almeidina" of fair ordinary quality, and valued it at 8d. to 10d. per lb. in London at the present time. They added, however, that there is only a very moderate demand for such material here.

Conclusions.

The investigation has shown that this species of Euphorbia, growing in the Transvaal, does not furnish a rubber-like product resembling that derived from *Euphorbia Intisy* in Madagascar, but a resinous material very similar to the "Almeidina" from West Africa. In view of the limited demand for almeidina, it is doubtful whether the price quoted would make the collection of the product remunerative in the Transvaal, but this is a point for local consideration.

(Signed) WYNDHAM R. DUNSTAN.

28th August, 1906.

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A Fruit Growers' Handbook.

We have received, through the courtesy of the Times Printing and Publishing Company, Ltd., Pietermaritzburg, a copy of "A Fruit Grower's Handbook," by Mr. Claude Fuller, the Entomologist to the Department of Agriculture. It is with pleasure that we welcome this timely volume, more particularly as it has special reference to Colonial conditions, and marks a gratifying addition to the agricultural literature of South Africa. The arrangement of the subject matter is good; the chapters are short, brightly written, and based on practical experience, and the illustrations are numerous and well chosen. Altogether, this volume should prove of great use, and we can confidently recommend it to our farmers.

In subsequent editions we hope that a larger type will be used. Formerly, it was supposed that anything was good enough for the farmer in the way of printing, but that day is past. We have always

held that the farmer is entitled to the best printing and the finest possible illustrations. Such a volume might well be modelled after the publications of the Rural Science Series (Editor, L. H. Bailey, published by the Macmillan Company) which have proved so valuable to the College graduate, as well as to the practical farmer. Finally, we cannot too strongly emphasise the point that our text books in South Africa should begin on a level with the best in existence if we are to fully win the sympathy of the farming population in the promulgation of the gospel of agriculture. (The price of this work is 7s. 6d., post free.)

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Products Exhibition.

To Captain P. C. van B. Bam, M.L.A. (Cape Colony), belongs the credit of the inception of the scheme for holding in London this year an Exhibition of South African Products, to which a reference was made in the last issue of this "Journal." Captain Bam, while in Canada in 1905, was much struck by the way both English and French Colonists there were combining to develop their agricultural resources, and he asked himself if something more that at present could not be done to bring the agricultural resources of the Cape Colony more prominently before the world.

After consultation with Dr. Jameson, the Premier of the Cape Colony; the Hon. A. Fuller, Secretary for Agriculture, and others, a general Exhibition in London was suggested for the Spring of 1907. The other Colonies were approached and eventually agreed to send exhibits and each contribute towards the general expenses. The Transvaal Department of Agriculture held that the Exhibition would be of greater benefit if postponed for two or three years, as our products would probably then be more varied and more uniform in quality. Further, no difficulty is apprehended at present in obtaining markets for the crops now produced, as we are not able to supply our own wants in any leading products with the exception of wool.

Representations were, however, made as to the desirability of the Transvaal falling into line with the other Colonies, and this Government accordingly agreed to support the scheme, although it was pointed out that the time of year at which the Exhibition was to be held debarred the Transvaal from exhibiting many of her best products.

A Committee, consisting of the following gentlemen: Messrs. F. B. Smith, M.L.C. (Chairman), J. Burtt-Davy, R. C. Francis, A. H. Malan, J. E. van der Merwe, T. Kleinenberg, F. T. Nicholson, H. F. E. Pistorius, J. C. Lucas, Captain C. A. Madge, H. A. Baily, J. G. van Boeschoten, T. W. Beckett, Dr. Gunning, Izaak Haarhoff, W. Hosken (M.L.C.), J. A. Dyce, J. Robinson, Professor Orr, R. A. Davis, C. E. Legat, T. N. de Villiers, A. G. Robertson, J. van Leenhoff, B. van Erkom, F. H. Hartley, W. McEvoy, E. P. A. Meintjes, G. R. Ockerse, M. F. Blundell, J. G. Hamilton, Jas. Shepherd, S. L. Kling, H. E. King (Secretary), was formed at Pretoria, and the various Sub-Committees then appointed, with the

result that the Committee had been able to despatch about 200 packages of exhibits up to the date of our going to press.

The exhibits forwarded, although in some classes disappointing, were considerable in number and of a varied nature, in spite of the fact that, amongst other things, fruit—in the development of the growth of which much is expected in the near future—had of necessity to be omitted.

The Transvaal Committee have endeavoured to draw, in an interesting manner, attention to some of the possibilities of the country. The Mining Industry has been referred to because, although gold, diamonds and other minerals cannot be considered as agricultural products, it is their presence that will make agriculture prosperous for many years to come, and an exhibition of Transvaal products would not be complete without some of the former. The enormous disproportion in value between the output of mineral and agricultural products will be readily grasped from the figures we have often published in this "Journal," and one of the objects of the Exhibition is to show the inducements offered to not only agricultural operations, but also to the investment of capital in the development of our latent industries.

The value of agricultural products realised falls far short of the quantity required for local consumption, and, therefore, the Transvaal is not at present concerned as regards most of her crops with an export trade, although she hopes to send away cotton, tobacco, fibre, and perhaps fruit, in the course of a few years. It is the latter contingency that has induced the Transvaal to recognise the possible utility of the proposed general commercial agency in England for products of all the South African Colonies which it has been suggested should be the outcome of the present Exhibition. Canada and Australia have found such a system of co-operation both beneficial and economical.

The following are the principal exhibits now *en route* to London:

ARTICLES RECEIVED FOR LONDON EXHIBITION.

27 Bales Ginned Cotton in Bales—9 varieties. 14 Bales (Model) Ginned Cotton in Bales—different varieties. Samples Ginned Cotton in Bales—several varieties. Samples Unginned Cotton in Bales—several varieties. Cotton Bolls—large varieties. 1 c/s Unginned Cotton from Swaziland. Unginned Cotton from Barberton.	Northern Transvaal.

Tobacco.

Leaf—A large variety from various Districts.
Roll—From various Districts.
Roll (large)—Made in 1903 by v. d. Westhuizen.
Roll (large)—Made in 1903, Rustenburg.
Manufactured—From Tzaneen, van Erkom, Hartley and others.

2 c/s Zoccola's Wines.
Specimens of Polished Granite.
,, Rough Granite.
,, Flint used in Tube Mills.
,, Red Sandstone.
,, Green Stone, ex Barberton.
,, Kaolin.
,, Marble.
,, Slate.
,, Cores from Bore-holes.
Coal from 15 Collieries (one piece weighing one ton).
2 Samples of the Main Reef.
Small Samples Gypsum.
Lime and Limestone.
Model of a Diamond Washing Plant, to be shewn in motion.
Model of the Cullinan Diamond.
"Alpha" Oils, etc.—Raw Linseed.
Ground Nut.
Sunflower.
Castor.
Cotton.
Oil Cake.
Specimens of Stream Tin from Swaziland.
Assorted Mineral Specimens from Swaziland.
General Collection of Rocks and Minerals of Transvaal.
24 Samples of Transvaal Soils in bottles.
5 Samples of Bat Guano.
1 Sample Vulture Excrement.
Van Wouw's Statue of "The Bushman."
Large Variety of—
Jams and Jellies.
Canned Fruit.
Canned Vegetables.
Pickles, Sauces and Liqueurs.
Native Curios—a large variety.
,, Carved Work ,,
,, Basket Work ,,
Articles manufactured by Natives.
22 Specimens of Native Barks and Grasses for thatching and other purposes.
Native Medicinal Roots and Herbs.
Mats made of Maize Leaves.
Mats made of Banana Leaves.
Walking Sticks of Hippo Hide.
Sjamboks.
Voerslag.
Reims—Game and Ox.
Reimpje Hides.
Native Fibres—a large variety.

Elands—Wortel.
Baviaans—Staart.
Mahogany Beans and Pods.
112 Vials Seeds of Cereals.
Oils.
Native Trees and Economic Plants.
Sample of Boer Salt.
Sample of Transvaal Salt.
Exhibits of Wool and Mohair.
Samples of Broom Corn and Brooms.
Miniature Bales of Oathay and Lucerne.
Bunches of Ears of different varieties of Wheat and Oats.
Small Samples of Maize in Cob and in Grain, about 40 varieties.
Ditto of different varieties of Wheat, Oats, Barley, Sorghum, Millet, Manna, etc.
Sample Case of Fanko.
3 Sacks Ground Nuts.
Ground Beans and Peas (Oil-producing).
Velvet Beans.
Samples of Wild Orange Fruit.
Cream of Tartar.
"Luffa" Plant.
Chicory.
Cassava.
Soy Beans.
Cape Barley.
Thibetan Barley.
Teosinte.
Egyptian Oats.
Millet.
Wol Corn.
Klein Corn.
Kaffir Corn Meal.
Stamped Mealies.
Crushed Mealies.
Mealie Meal.
Boer Meal (Sifted).
Boer Meal (Unsifted).
Wheat—a Variety.
Oats.
Barley.
Lucerne.
Oathay Forage.
Kaffir Corn (Red).
Kaffir Corn (White).
"Hickory King" Mealies (White).
" " " (Yellow).
Peas.

Pumpkins.
Specimens of Local Printing.
Department Reports and Bulletins.
Large Variety of Maps, Diagrams and Photographs.
13 Large Photographs of Government House.
27 „ „ Experimental Farm, Potchefstroom.
Photographs of Various Quarries and the Lombardy Vineyard.
1 Large Model, 23 ft. x 16 ft. representing the gold output to date.
Black Wattle Bark.
4 Chairs made of Various Native Woods.
16 Samples of Native Woods.
Pebbles and Wash from Vaal River Diamond Diggings.
Wild Honey (Krugersdorp).
Native Bee Hive „
Tortoise Shell „
Sample Asbestos (Pietersburg).
Sample Paints and Pigments (Krugersdorp).
Small Piece Tweed made from Local Wool (Standerton).
Marble (further sample).
Various Ores from Krugersdorp and Rustenburg.
Sample Dried Locusts.

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REVIEWS.

Irrigation and Land Drainage. *By* W. G. Cox.

This is a well printed and freely illustrated book of 291 pages. The first portion is practically confined to a description and history of the artesian area in Australia, and the author then deals with sub-artesian supplies, irrigation, brak and drainage. Mr. Cox, in 1902, had a series of articles on the Queensland artesian wells in the "Engineer," and his book brings the subject up-to-date. A chapter is devoted to the discharge of fresh water into the ocean below sea level, and several cases are given where this is known to occur; but no mention is made of similar instances in the Mediterranean and the Lake of Aral. The author gives an extremely interesting example of the oscillation of water level in wells. At Urisino Station there is a well 1,710 feet deep in which the water rises to about 17 feet below the surface. The oscillation or variation of time between the successive ebbs and flows was about 9 to 14 hours, and the rise and fall of the water varied from about 3 feet 3 inches to 3 feet 9 inches. That was the result of obervations in 1897. A few records kept in 1894 gave intervals of 17½ hours, and those in 1896 of about 10 hours. No mention is made of the height above sea level or the distance from the coast, and, although it is of extreme scientific interest, it is only given as a remarkable fact. A very striking instance of this is found near Cradock, in Cape Colony, where fluctuations, accompanied with great quantities of inflammable gas,

occur in an artesian well 65 feet deep, over 2,700 feet above sea level, and fully 100 miles from the coast. The oscillations in this well show a marked variation similar to marine tides. A paper on this was read before the British Association by Prof. A. Young. Mr. Cox refers to this, and says the opinion was put forward that the artesian water is subject to the same law as is that of the ocean. The Report of the British Association says: "it was suggested that the water rises through a fissure-system from a depth of several thousand feet mainly under the influence of natural gas, and that the tidal fluctuation is a minor lunar effect superimposed on the effect of fairly constant gas pressure."

Many people have an idea that artesian wells are inexhaustible, but this is quite an erroneous idea, and, although the Australians have, with the exception of the Dakota basin in U.S.A., the largest known artesian basin in the world, they are already thinking how the permanence of the supply may be maintained. The present supply from wells in New South Wales and Queensland amounts to 546,000,000 gallons a day, and they may well tremble lest this should not last. Mr. Cox puts forward the suggestion that a portion of the outcrop area might be cleared down to the porous rocks so as to increase the volume of water absorbed. But when one considers that the absorbent or outcrop area (it is not quite clear if this is for Queensland or New South Wales, or both) covers, approximately, 18,000 square miles, one gets a faint idea of the utter hopelessness of such a work. On page 68 we find this statement: "So soon as the sun asserts itself, the surface, as a rule, becomes in a short time—a few hours at most—caked or hardened, and this hardening acts as a covering, or anti-evaporative, to the water below." This is quite incorrect, and it is curious that it should be advanced as an argument, for, on pp. 202, 214, he states—*this time correctly*—that a loose, dry, mulch *prevents* evaporation. Then, in discussing the irrigation of fruit trees, he says that the rootlets seek the very top of the soil for sunshine and air to support and mature the fruit. Where did Mr. Cox get this idea? Air is taken in through the leaves, and it is the rootlets that absorb the bulk of the moisture required for plant growth. Shallow-rooted fruit trees invariably suffer from having their roots in the dry surface soil and very frequently die. But the author is quite sound when he insists on continual cultivation and on the great care that should be taken not to over irrigate crops.

The impression left on the mind after reading the remarks on sub-irrigation by means of pipes is that Mr. Cox recommends the system. He does not give any instances where it is used in Australia, but refers to the U.S.A. There, however, it has not been an unqualified success, and one American authority (Mr. H. M. Wilson) says that, on the whole, sub-irrigation is troublesome and expensive to operate, and, as it does not accord too well with the theoretical requirements of plants and soil, it is probable that it will be less adopted in the future. We also take exception to a table on page 137 shewing the percentage of water evaporated from different soils in

four hours. These figures must be accepted with the greatest caution, for the author does not state the thickness of the layers experimented on. It is clear that the evaporation from a given area ¼ inch deep would not be the same as that from a similar area 3 feet deep. According to the table, common arable land absorbs 52% of moisture, and looses 32% by evaporation in four hours. At this rate the soil would be dry in less than seven hours. This might easily happen with a thin experimental layer, but if it applied generally the world would be as dry as a cinder after a few hours sunshine.

Mr. Cox states that the deepest well in Australia is at Bimerah, in Queensland, where a hole has been drilled 5,045 feet deep. Wells discharging 4,000,000 gallons a day seem quite common, and it is only the 6,000,000 gallons a day from the Coongoola well that is described as a phenomenal output! The book contains a large amount of valuable information on Australian artesian wells that is not available for the ordinary reader. It is written in an easy, popular manner, very few technical terms are used, theory is pretty well kept in the background, and it is well worth reading by the general public. It is a pity that credit is not given to other works from which some passages are bodily taken and 37 illustrations have already appeared in American books. As a matter of scientific interest we regret that geological sections through various parts of the artesian basins are not given. South African readers must not think that because well boring has been so successful in Australia, that it should be the same here. Artesian wells can only occur where the geological formation is favourable.—(C. DIMOND H. BRAINE.)

* * * *

The S.A. Stud Book.

Another volume of note, and one which marks a new era in the agricultural industry of South Africa, is the first volume of the South African Stud Book. This book is neatly bound, well arranged, and clearly printed. The frontispiece is an excellent likeness of the Patron, His Excellency the High Commissioner, to whose valuable assistance tribute is paid by the Council in their report.

The reports prove that much trouble has been taken by Inspectors to convey to the Stock Committees correct ideas of the stock examined, and the Council fully recognise the good work thus accomplished.

The Stock Committees have proved the practical interest in the thoroughbred and high-bred stock of the country, they having had to devote both time and expense in attending to this work. With such breeders, the stock of South Africa should have a great future.

The Council, in presenting this first volume, are glad to be able to congratulate the whole country upon the success which has attended this initial effort, which makes no claim to being all that it should be, and asks for lenient judgment upon this first attempt to place before the country a stud book volume. The thoughtful will recognise the many difficulties there are in dealing with a subject so great in a country like ours, of vast distances, and further desires to place on

record their high appreciation for the co-operation, enterprise, and ready help of the breeders interested, whose stock have proved to be of very high order, and will, in the future, be a still greater mine of wealth in South Africa.

The Stock Committees for the Transvaal are:—

(1) *Boer Horse Section.*

Messrs. Erasmus, Robertson, Everard, Blackburne, Malan, Joubert, Jurriers, Dale, McNae, Holm and F. T. Nicholson.

(2) *Cattle Section.*

Ayrshires and other Imported Breeds.—Messrs. MacDonald, Noyce, Holm, Grimes, Whitfield, Scott, Malan, Macmillan, Barron and Enschede.

Africanders.—Messrs. Moodie, Erasmus, van Deventer, Malan, MacDonald and Robertson.

Frieslands.—Messrs. Enschede, Malan, van Niekerk, van der Merwe and B. Emmett.

(3) *Merino Sheep Section.*

Messrs. Buhrmann, Labuschangne, Groesbeek, Kolbe, Pistorius, Vermaas, Malan, Devel, A. Coetzee and A. G. Robertson.

(4) *Persian and Africander Sheep Sections.*

Messrs. F. P. van Deventer, Gadd, Holm, Vermaas, van Heerden, Gorringe, Gilfillan, Fante, C. H. Zeederberg.

(5) *Pig Section.*

Messrs. Tooley, Coote, Holm, Gibson, McNally, and J. de Mestre.

Inspectors for the Transvaal:—

Cattle.

General Inspector.—J. J. Enschede.

Sheep and Goats.

Merino, Persian and Afrikander.—A. G. Robertson.

Horses.

Boer.—Thomas Everard.

* * * *

We congratulate the Editorial Committee—Messrs. C. G. Lee, J. Rawbone, F. D. MacDermott, E. J. Macmillan, T. Everard, C. B. Blackburne—on the production of a volume which must assuredly find a place in the home of every farmer and stockbreeder in the Transvaal.

* * * *

The "Farmer's Advocate."

It is with pleasure that we direct our readers' attention to the "Farmer's Advocate," which has been recently started in this Colony. This publication is the official organ of the Transvaal Agricultural Union, as well as of the Poultry Club. It appears in the first week of each month, and is published in English and Dutch. A special feature of the "Advocate"

will be illustrated articles on the various stock breeders of South Africa, and a series of papers on "Farmers at Home." An attempt will be made to cover the more important branches of modern farming and stock-breeding, and, at the same time, to report all agricultural progress in the Colony.

In every great agricultural country such as England, America, Canada, and Australia, agricultural journalism is a large and growing profession, but in South Africa, outside four Government publications and with the exception of the "Farmer's Advocate" in the Orange River Colony, there is, we believe, no paper devoted entirely to the interests of the farming population. The spirited enterprise which has founded the "Advocate" is all the more gratifying, and we would cordially commend this magazine to the practical support of our readers.

The Editor, Mr. Matt Lochead, will always be glad to see readers of the "Advocate" at 736, Vermeulen Street. Letters should be addressed to P.O. Box 134, Pretoria. The subscription to the "Advocate" is 7s. 6d. per annum, postage paid.

* * * *

Fencing.

Lately, the Secretary of the Waterberg Agricultural Society wrote to the Director of Agriculture asking if there was any possibility of the railway line being fenced from Tweefontein to Nylstroom. It was pointed out that Mr. de Beer, of Tweefontein, and Mr. van Niekerk, of Vygeboomspoort, had recently cattle killed along the line. Mr. F. B. Smith communicated with Mr. T. R. Price, General Manager, and was informed that the whole of the 91 miles on the northern line will be fenced in, including the following sections:—

	Miles.
Southern boundary of Turfbult to Nylstroom—mileage, 59¾ to 81¾	44
Southern boundary of Rotterdam to Pietersburg Railway Station—mileage, 159 to 176..	34
Wonderboom to northern boundary, Vastfontein (actual fencing required)	13
	91

* * * *

Land Owners' Association.

The following extract from the annual report of the general committee of the Transvaal Landowners' Association may be of interest:—

OSTRICH FARMING.

Several experiments in ostrich farming are in progress on farms situated in the bushveld, and the results obtained are distinctly encouraging. Further, there is every prospect that lucerne will thrive on unirrigated land in certain portions of the country with proper care in cultivation. If this proves to be

the case, a great impetus will be given to the establishment of an industry which is so highly organised in the Cape Colony, so thoroughly understood by the Colonial farmer, and which, if established in the Transvaal will do so much to forward the settlement of large areas of unoccupied country. While your committee recognise that the development of the ostrich industry should be carried out by private enterprise, they consider that the Government can, and should, assist the farmers by experimental work, by introducing first-class stock, by experiments in breeding wild with domesticated birds, and by placing facilities at the disposal of farmers for acquiring good birds at reasonable rates. For this reason they recommend that the Government should pay special attention to ostriches in the Bushveld Experimental Farm, advocated elsewhere in this report. The importance of this subject can be gauged when it is borne in mind that the export of feathers from the Cape Colony for the year ending June, 1906, amounted to £1,246,558.

Agricultural Labour.

No improvement can be reported in the supply of Kaffir labour on farms. The demand for more farm labour continues in spite of the general depression, and farmers are still severely handicapped in consequence. The following figures show the maximum number of natives employed in a given month in the labour area during the past four years, and your attention is drawn to the fact that the number of natives employed otherwise than on farms, mines, and works, continues to steadily increase:—

Month.		Mines and works.	Other employ.	Total.
December, 1903	..	69,970	59,229	129,199
December, 1904	..	85,751	67,178	152,929
April, 1905	..	110,861	74,820	185,681
April, 1906	..	95,458	84,522	179,980

In addition to this, the development of the Transvaal diamond industry during the past five years is an important factor, for, to-day, this new industry employs approximately 8,000 natives, and its requirements appear likely to increase. It is difficult to suggest a remedy, for the farmer cannot afford to pay as high wages as the mines, and there is no likelihood of the demands of the mines and towns diminishing, for, at the present time, the supply does not nearly approximate the demand, and the latter is daily increasing. If farmers would use the most modern labour-saving machinery procurable their difficulties would be lessened. It should be possible to obtain skilled white labour for such machinery if industrial schools were established in various districts, and the energies of the poorer youth of the community were, from an early age, stimulated and directed in the proper channel. The advantages of such a training to the youth of the country cannot be over-estimated, and it is a life to which they

are predisposed and well adapted. The Government, desiring to improve the supply of agricultural labour, have amended the Native Tax Ordinance No. 20 of 1902. The amendments were, unfortunately, hurried through the Legislative Council, and the Ordinance as passed is not considered satisfactory; therefore steps will be taken as soon as practicable to bring it more in accordance with the views of the farming community.

Teaching of Agriculture.

The official census returns show that, in 1904, the white children of both sexes in the Transvaal and Swaziland between the age of 5 and under 15 were over 60,000 in number. Of these, over 30,000 were males. The future livelihood of a large proportion of these children must be gained on the land. Probably in no country in the world is there greater need for the application of good management, combined with sound scientific principles, to get good returns from the land. In order, therefore, to enable the youth of the country to successfully overcome the difficulties they will encounter, it is essential that they should be properly equipped to commence with. Your committee considered, therefore, that the teaching of agriculture is of the utmost importance, and that, in addition to the elementary agricultural education which should be taught in the country schools, it is urgently necessary that a well-endowed College of Agriculture be established, where the principles of agriculture would be taught and supplemented by courses of practical training on the various Government Experimental Farms.

* * * *

Preserving Citrus.

During our recent visit to California, the Secretary to the Los Angeles Board of Trade kindly gave us the following formula for preserving citrus and other fruits which may be of value to our fruit growers in view of future exhibitions:—

After the fruit has been carefully selected, avoiding that which is blemished or in any way bruised, place in the receptacle in which it is to be preserved, cover with clean, clear water, and thoroughly rinse the fruit without removing it from the vessel. Cover it with a preparation prepared as follows:—

To every gallon of distilled water add 2 ozs. of fresh *sulphurous* acid. Stir well, pour this over the fruit, covering it at least an inch and a half to two inches.

Set aside in a dark room for thirty days. If any change takes place, such as fermentation or discolouration, pour off the liquid and rinse the fruit, and renew the preparation prepared under the same formula as before.

If, after thirty days, the fruit still discolours or ferments, it is useless to undertake to carry it through. The only thing to do is to prepare a fresh lot.

This preparation will answer for many other varieties of fruit provided they have a tough skin. Certain varieties of peaches, pears,

and apricots can be successfully preserved under the same formula by adding to the preparation, for peaches and apricots, 8 to 10 ozs. of glycerine, depending altogether on the amount of sugar contained therein. If you desire to be more accurate as to the amount of glycerine actually required, ascertain the density of the juice of the fruit you desire to put up and add sufficient glycerine to the water to make its density equivalent to the juices of the fruit.

With this preparation we cannot guarantee the retention of the natural colour, as ofttimes the acid destroys the bloom and the highly-coloured fruit. To obviate this bleaching, we suggest pouring off the liquid after it has stood for five or six days; rinse the fruit in clear water and let it stand for four or five hours, and then renew the preparation, repeating this operation until you are convinced that the colour is thoroughly set and the chemical action to destroy the fruit has ceased

One of the great secrets of keeping fruit under this formula is to keep it in a dark place for from 30 to 40 days in a temperature ranging from 40° to 60°.

When placing it on exhibition, care should be taken to keep it out of the strong light. In purchasing the sulphurous acid, be careful that you get the fresh article, and that you get *sulphurous* and not *sulphuric* acid.

* * * *

Destructive Birds.

Mr. C. Harvey, of the Trout Hatchery, Potchefstroom, writes on the above subject as follows:—

"I read Mr. Bucknill's letter under the above heading in the last issue of your 'Journal' with great interest, more especially as I live in a district where these two varieties of birds, viz., Red Bishop Bird and Great Tailed Widow Bird, respectively, occur. Without a doubt these birds are the most destructive to crops along the Mooi River, and, unless scared constantly, will soon denude a forage crop of its grain.

"It is a well-known fact that these birds build their nests in small colonies—I have counted 50 on a space of about 20 square yards—and, owing to the positions in which they are usually placed, in reeds and overhanging branches of willow trees, the young are very immune from natural enemies; as a consequence they must rapidly increase unless preventive measures are taken.

"I would suggest that a practical and easy means of getting rid of these pests is to destroy their nests persistently during the breeding season, which is during November and December."

* * * *

Arid Farming.

Just as we go to press, Mr. David Forbes, of Athole, writes as follows:—

"The Springs-Eastward railway runs through a most fertile country. The soil is formed by decomposed basaltic rock. From the railway one sees vast stretches of open flat country on each side of the line, where it would be possible to plough fields miles in

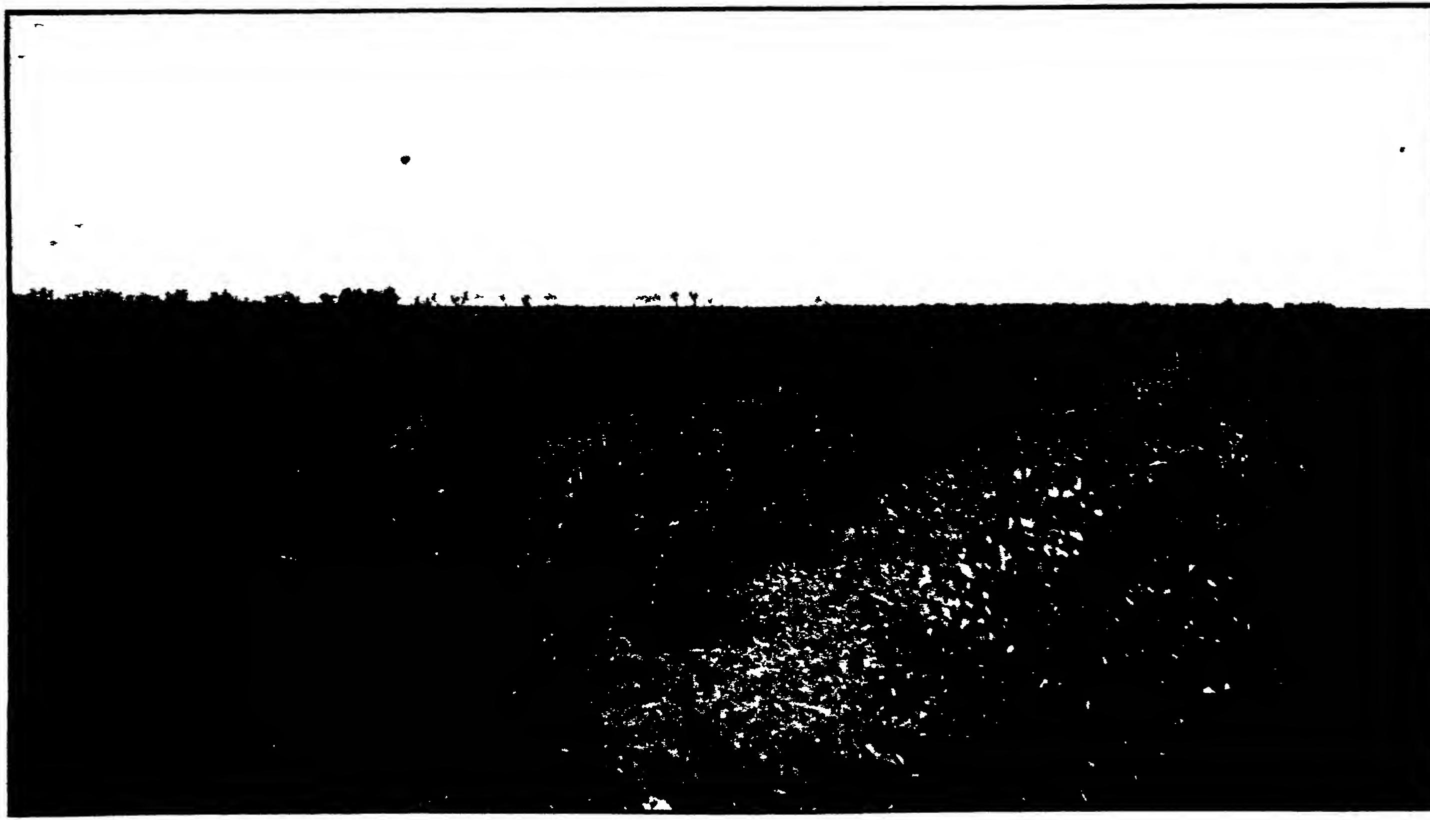

Plate CLXVIII.

Plantation of young Eucalyptus Coriacea on the farm of Mr. V. L. Robertson, Rolfontein, Wakkerstroom.

These trees successfully withstood 26 degrees of frost owing to winter cultivation

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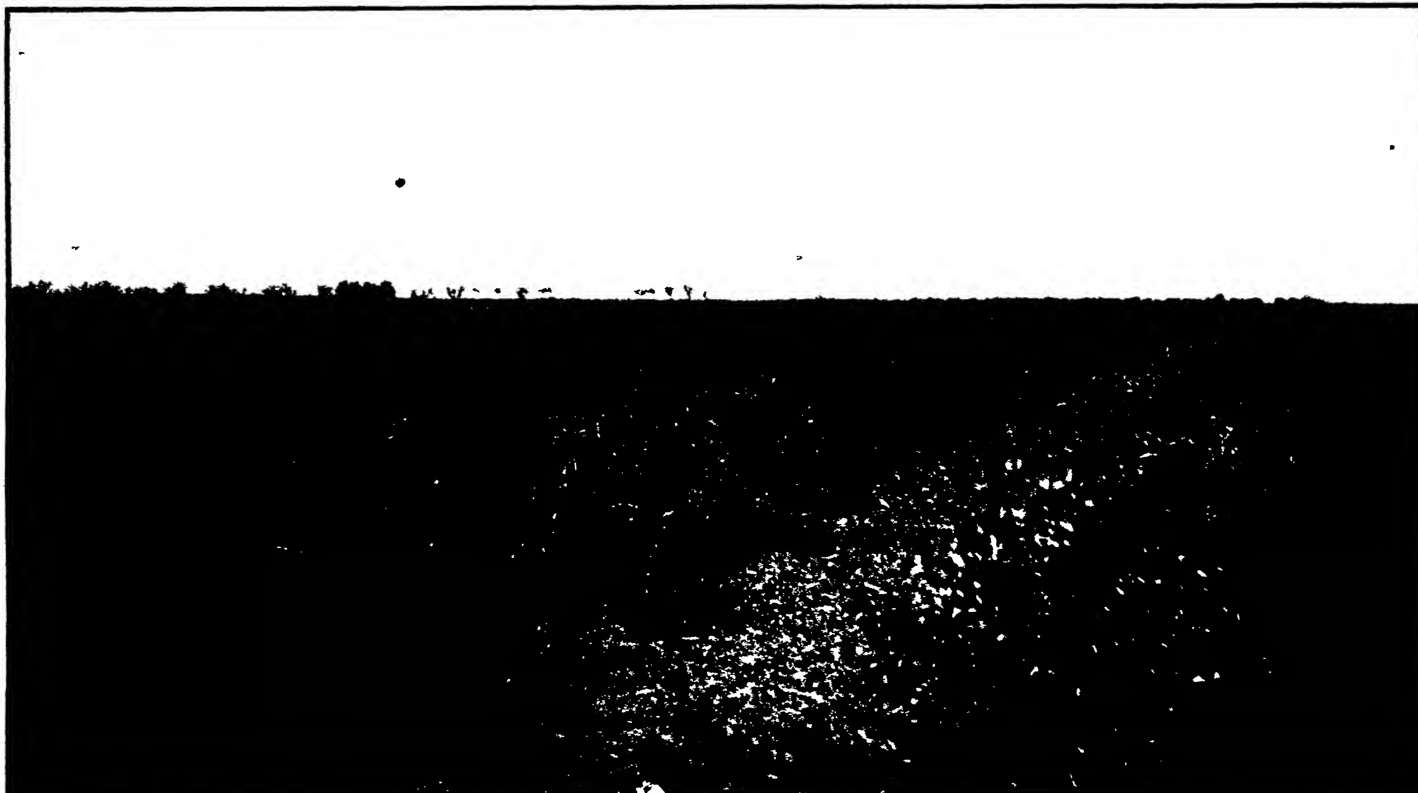

Plate CLXVII.

Plantation of young Eucalyptus Coriacea on the farm of Mr. V. L. Robertson, Rolfontein, Wakkerstroom.

These trees successfully withstood 26 degrees of frost, owing to winter cultivation.

length. When on the railway line it gives one the impression that the ground is very shallow as the line runs along a watershed which has no depth of soil on it, but away from the line on the flats the soil is deep, and is, I should say, as fertile as any land in the Transvaal, besides being the most healthy country for man and beast in this Colony. The land on the tops of the ridges is the most fertile when of sufficient depth, that is, on some ridges the soil is not so deep on account of the underlying basaltic rock. The one drawback of the district or part of the country is the want of water, there being very few springs and permanent water holes. Provided moisture can be conserved, there should be no better agricultural district in South Africa. This country is eminently adapted for experiments in arid farming."

The Director of Meteorology writes us: "All over the Transvaal, even in the driest parts, the rainfall in the worst years does not fall below 13 to 15 inches, practically all of which falls between the 1st of October and the 30th of April, viz., in the growing season.

"Moreover, in a good year, as much as 100 inches may be expected in the most favoured regions, as, for example, in the Woodbush Forest in the Zoutpansberg, or at Belvedere on the seaward slope of the Drakensberg. So, if dry farming is possible with 15 inches of rainfall, the whole of the Transvaal is suitable for this system of agriculture."

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Frost and Cultivation.

We would call attention to Plate CLXXVII., which was kindly forwarded to us by Mr. V. L. Robertson, of Rolfontein, Amersfoort, which is most instructive in connection with dry land farming.

Mr. Robertson writes as follows:—"These trees are well cultivated with a 3-inch mulch to preserve moisture—a small plot at one side was purposely left with a hard crust, and these have suffered very much from frost, thus showing that good cultivation to retain moisture is necessary to grow these trees in this cold part. Some of the trees are 7 feet high, and were put out last December."

* * * *

Protection against Hail.

Several of our correspondents are interested in the question of covering grape vines with small wire netting as a protection from hailstorms. We have made calculations, but find that the cost of the wire mesh and the necessary supports puts the matter quite out of the question for the present. However, we shall be glad to receive any further data from our readers.

Mr. F. J. Carpenter kindly sends us the following:—

Revenue from an Acre of Vines.

Planted 4 feet apart in rows which are 5 feet apart, and allowing for paths, you would get about 2,100 vines to the acre. "Frankenwald" vines 4 years of age and upwards yield about 3 lbs. of good

marketable fruit per vine. This means, say, 6,300 lbs. per acre. Prices vary according to the season—early fruit realising about 6d. per lb. on the market, but, at the end of the season when the Cape fruit comes in large quantites, the local fruit realises only about 2½d. per lb. I find our average is about 3d. per lb. all through the season, which, I think, is a fair figure to take—6,300 lbs. @ 3d.=£78 15s. gross revenue per acre.

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Tropical Diseases.

We are glad to welcome Dr. Phil. Paul Knuth, Chief of the Department of Tropical Hygiene in the Institute of Hygiene of Berlin. Dr. Knuth has been commissioned by the Imperial German Government to study tropical diseases in practically the whole of Africa. He bears credentials from Sir Edward Grey, Secretary of State for Foreign Affairs, addressed to the various Governors of the British States in Africa, and we are sure our readers will be glad to render him any practical assistance in pursuing his important investigations. Dr. Knuth has already spent five weeks with Dr. Theiler at the Government Veterinary Laboratories, and he mentioned that the work in progress at Daspoort must prove of inestimable value to the whole of South Africa. Dr. Knuth is specially interested in certain phases of this particular line of research, as he had made a critical study of Texas Fever in South America. It is with pleasure that we welcome so distinguished a Scientist to the Transvaal, and we are sure that his studies cannot fail to illuminate the great subject of animal diseases in this part of the world.

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Plant Experiments.

It is with pleasure that we announce the appointment of Mr. Hugh Godfrey Mundy to the post of Assistant for Seed and Plant Experiments in the place of Mr. Hugh S. Sampson, B.Sc., who recently left to take up an important post under the Government of India. Mr. Mundy studied at the South Eastern Agricultural College, Wye, and he holds the Diploma of that institution in Agricultural Science. On leaving Wye, Mr. Mundy was appointed to Rothamstead, where he worked on grasses and pasture land experiments. Later, he acted in the capacity of Assistant to the Professor of Agriculture at the Armstrong College of Science, Newcastle, from whence he was transferred to the Transvaal Department of Agriculture. The appointment of Mr. Mundy will enable the Division of Botany to cope more effectively with the important branches of Seed Testing and Plant Breeding.

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A Farmer's Almanack.

We are requested by Messrs. Hayward, Young & Company, Port Elizabeth, to mention that they will be very pleased to send to any farmer a copy of one of their Almanacks for 1907 in English and Dutch.

THE LATE MR. C. B. SIMPSON.

It is with great regret that we have to record the death of Mr. C. B. Simpson, Entomologist to the Department of Agriculture, which occurred at his residence in Arcadia. Mr. Simpson had been suffering from enteric fever for some time past, and passed away on the morning of January 15th. Mr. Simpson was born in the State of California in the year 1876. From California he went to Idaho, and graduated as Bachelor of Science in the University there. Later on he went to the University of Cornell, in the State of New York, where he devoted himself more particularly to entomology – a branch in which he rendered so conspicuous service. Mr. Simpson took his M.A. degree at Cornell, and was subsequently attached to the United States Department of Agriculture as Field Entomologist. Whilst in this post he published a comprehensive bulletin on the Codling Moth, which has ever since been recognised as the standard treatise on this subject. On the recommendation of the American Agricultural Department, Mr. Simpson was appointed to the post in the Department which he held at the time of his death.

The Division of Entomology was begun by Mr. Simpson, and the success of this branch of the Department proved, in a most marked manner, his strong capacity for organisation. All our readers are well aware of his sterling work in connection with the recent campaign against locusts and his enthusiastic devotion to this crusade, the final issue of which he never had any doubt.

Mr. Simpson will be greatly missed by the farmers of the Transvaal as well as by the whole staff of the Department, where he proved himself a universal favourite and a most genial colleague. On behalf of the Director and all the members of the Department we would offer our deepest sympathy to his widow and sorrowing parents.

Tobacco Plant Diseases.

A large number of letters and verbal enquiries have been received by the Tobacco Division in regard to diseases and insects injurious to tobacco plants. It is impossible to give any reliable advice as to remedies for different diseases and insect pests unless a specimen of the affected plant is forwarded to us, and our readers are, therefore, requested to furnish a portion of the affected plant when writing for advice in such matters. Most of the diseases and insect pests which attack tobacco plants in the Transvaal are easily controlled. Letters and parcels may be sent free of charge if addressed as follows:—

O.H.M.S.

Mr. J. van Leenhoff,
Government Tobacco Expert,
Department of Agriculture,
Pretoria.

* * * *

Agricultural Shows.

Mr. F. T. Nicholson, the Secretary of the Transvaal Agricultural Union, has kindly sent us the following list of dates of shows:—

Aliwal North, C.C.—12th and 13th February.
Rosebank, C.C.—19th, 20th, and 21st February.
Volksrust—27th and 28th February.
Kingwilliamstown, C.C.—28th February and 1st March.
Ermelo—4th March.
Carolina—6th March.
East London—7th and 8th March.
Bloemfontein, O.R.C.—19th to 21st March.
Klerksdorp—17th April.
Potchefstroom—24th April.
Johanesburg—1st to 3rd May.
Pretoria—about the end of May.

CORRESPONDENCE.

This column will be devoted to correspondence, and an endeavour made to reply to all inquiries upon agricultural topics, or concerning any of the articles published from time to time in the *Journal*.

Correspondents will kindly write on one side of the paper only. No manuscript will be returned.

All letters must be addressed to the Editor of the "Agricultural Journal," Department of Agriculture, Pretoria.

CO-OPERATIVE CREAMERIES.

To the Editor of the Agricultural Journal.

Sir,—The establishment of a Central Creamery in or near Pretoria seems such a necessary and useful undertaking in the interests of the farming community that one wonders that neither the Department of Agriculture nor the Pretoria Agricultural Society has taken the matter up. It hardly requires any argument to demonstrate the advantage which will accrue from such a concern. Most of the farmers not only in the district of Pretoria but also in the surrounding districts are once more in possession of some cattle—many of them, unfortunately, have only a few cows, others, perhaps, have been fortunate enough to get together a small herd. Generally speaking, the farmer of the Transvaal has hitherto been content to make out of his herd of cattle only such profit as he can realise by the sale of the increase in stock; he has not realised that it is possible for him to derive considerable profit from his cows by selling milk or butter. If he has some cows in milk he has been content to make perhaps sufficient butter for his domestic use, but seldom does he make any effort to sell milk or butter unless he happens to live in the outskirts of a town. And, indeed, there are so many difficulties in his way, so little inducement for him to indulge in such an enterprise that it is no wonder he has hitherto been content to regard the sale of slaughter oxen as the sole profit to be derived from his herd. The writer has in mind the following instance. On a farm about 26 miles from Pretoria, and about five from the nearest railway station, the milk supply was sufficient to permit of about 12 lbs. of butter being made per week, the cream being hand-skimmed. A few weeks ago a separator was bought, and, during the first week in which it was used, such an increased quantity of cream was obtained that the farmer managed to make 24 lbs. (double the quantity) of butter that week, even though his milk supply was somewhat less on account of the veld being very dry. Within the next few weeks some more cows will be in milk, and the weekly quantity of butter will be increased. But how is the owner to dispose of his butter? It does not pay him to drive all this distance into town more than once a week for so small a quantity of butter. It is no easy task to make good butter and to keep it fresh and firm in this hot weather, and he ought to sell it as

soon as it is made. When he does bring it into town and puts it on the market, he will possibly only be offered 10d. or 1s. a lb. for it! If he sends it in by rail, he runs the risk of the butter being melted in transit. His output of butter is not large enough to enable him to open a depot in town. Now, if a creamery were established in or near Pretoria, it would be possible for him to send in his supply of cream by rail three or four times a week, and to make about £8 or £10 a month from the sale of his cream, and he would be saved the labour of making butter, transporting it and finding a market for it. And this would apply to every farmer within reach of the railway.

During the summer months every farmer, even if he has only a few cows, will be able to supply the central creamery with this quota of cream. When once he has learnt to make a few pounds a month out of his cream during the summer months, he will be anxious to increase that revenue, and will probably improve his strain of cows and make an effort to cut grass or grow some winter feed for his cows so as to maintain his income even in winter. The sale of milk is more profitable than the sale of cream, but very few farmers can afford a sterilising plant, and, therefore, cannot send milk a long distance; those, however, who are near enough to a creamery will be able to make a large profit by sending their milk to it. It is not putting it too high to say that every cow—even the ordinary Africander type—ought to be worth to its owner at least 10s. a month in milk or cream. In the Eastern Province of the Cape Colony where Co-operative Creameries have been started, farmers who looked formerly solely to the increase of their stock for profit, now derive an income of from £50 to £250 a year from their milk supply.

Pretoria seems singularly suitable for a Central Creamery. Why does the Government not erect one? Such a Creamery will be fed from lines of railway which will gain some traffic. People as far as Pietersburg, Middelburg, or Rustenburg, will be able to send their supply of cream to the central depot. Such a Creamery will not only be a liberal education to the people of the country in teaching them what profit there is to be made out of even a small herd of cows, but it ought also to prove to be a commercially sound and profitable undertaking; it should be able within a few years to supply the whole population of Pretoria with fresh butter, and make the imported article an unknown quantity here. And if the Government cannot afford to bear the expense of erecting the necessary plant, is it not possible for the Government to contribute on the £ for £ principle and thus make it possible for the farmers to co-operate in subscribing the requisite capital?

A start could be made with only a small plant, which ought not to cost more than about £2,500. If the Government could contribute £1,250, it ought to be possible to get the farmers to co-operate and subscribe the balance. Many who are not farmers would possibly be disposed to subscribe, but it is essential that the farming population should be personally interested in the success of the venture. Let the shares be 5s. in value so that every farmer, however humble his means,

might be able to participate in the concern, the wider the interest is distributed the greater will be the benefit conferred. Is it too much to commend some co-operation in this direction to the Pretoria Agricultural Society or to the leading men amongst our Boer friends?

Yours, etc.,
JOHN CURLEWIS.

Judge's Chambers,
Pretoria.

* * * *

ERECTION OF GOVERNMENT CREAMERY.

To the Editor of the Agricultural Journal.

Sir,—I beg to submit a suggestion for the erection and management of a creamery by the Government.

A number of small farmers of my acquaintance have, on various occasions, expressed to me the opinion that if the Government were to go to the expense of erecting such a creamery, many farmers would endeavour to supply the necessary quantity of milk. By taking the step here suggested, Government would be aiding an industry that must, in course of time, prove, at least, sufficiently lucrative to repay the Government for its initial expenditure, and give direct and material encouragement to farmers to sow greater areas of lucerne and other fodder than it pays them to do under existing conditions.

Between Johannesburg and the Yokeskei River there is a large number of owners of small holdings (say, from 10 to 30 acres in extent) who would gladly avail themselves of an opportunity to supply a creamery with milk. But, owing to the fact that no certain market of this sort exists at present, these people cannot afford to risk money in purchasing cows.

I believe that a guarantee could be obtained from, say, 25 or 30 farmers to supply a certain minimum quantity of milk per day at a price to be fixed. It will, no doubt, be unnecessary to remind you that a creamery of this description would render great service to the Colony by helping to supply local needs better and more cheaply than can be done by the imported article. As you are no doubt aware, creameries supported by Government have proved highly successful in New Zealand, Australia, and other parts of the world, both by increasing the prosperity of the farmers, and by making it possible for increased numbers to make a living from the land.

The Transvaal Government has done much for the large farmers by starting and maintaining experimental farms and by introducing improved breeds of stock. For the small farmer, however, less has been done, but were my suggestion to be adopted, wholly or in part, great encouragement would be given to the latter, with the ultimate result that the inducements to settle on the land would be rendered more attractive.

Yours, etc.,
K. W. HANSEN.

Norwood, Johannesburg.

CO-OPERATION.

To the Editor of the Agricultural Journal.

Sir,—One cannot appreciate too highly the efforts being made for the improvement of our agricultural communities as set forth from time to time in the "Journal"—irrigation schemes, agricultural schools, land banks, co-operative depots, etc., but I venture to suggest that most of these are directed rather to future than immediate betterment.

To those who, like myself, are continually brought into touch with the farming population in their own homes, there is no doubt of the dire poverty existing among them, not only among those of the "bywoner" class, but also those who were in affluent positions before the war owing to the succession of disasters and set-backs that have occured each year; to such an extent is this the case in this district that many are dependent on their more fortunate neighbours for bare necessaries of life, especially in case of sickness, and what is really wanted is a scheme by which they could *at once* be enabled to cope with their misfortunes; doubtless the same holds good in other parts of the Transvaal.

Undoubtedly the land banks will be a step in the right direction, and I understand these are likely to be instituted, but it is to co-operation that I think we should look for immediate and steady amelioration by bringing the producer and consumer together.

When I first came to this fertile valley, I was astounded to find that I could not purchase such things as butter, milk, vegetables, fruit, eggs, fowls, etc., except occasionally as a personal favour, but the reason was not far to seek. Each farmer produces such commodities, only in sufficient quantities for his own use. To sell on the Krugersdorp market is not worth the transport. Practically the only green vegetables I could get until I had my own garden were at my monthly visits to Krugersdorp, when I returned with a whole sack full of assorted green food for 2s. or 2s. 6d., or when I could meet with them from a peripatetic "Sammy" at exorbitant prices.

The two staple industries are oat-forage and tobacco, and should any calamity arise, as has been the case every year of late, *e.g.*, cattle disease, locusts, and the recent hailstorm, the farmer without a fairly large capital is ruined for the year.

So far as this district is concerned, the scheme I propose (in fact, had I had the spare capital at command I should have initiated it myself) is practically on lines similar to those institutions existing in New Zealand among the "cockatoos," or small farmers, namely:—

(1) To commence operations in a small way with a capital of, say, £1,000 or £2,000 in £5 shares, and, as circumstances warranted extension for further development, as dairying, fruit preserving, etc., to issue further shares, those of original holders being transformed into "founders" shares bearing a larger proportion of interest.

(2) To have a central depot at the nearest railway (in our case the new station at Blauwbank, about 10 miles distant from the South

African Constabulary Headquarters) available to all farmers, and two, three or more small collecting sheds, in charge of intelligent natives, where farmers could bring their produce within a quick transport of the central depot.

(3) Milk, butter, eggs, fowls, and other perishable articles to be delivered *daily* at the central depot by light transport carts.

(4) The manager at the central depot to arrange contracts with shopkeepers, hotel proprietors and others at Johannesburg and other populous centres on the line for *daily* supply, and see that the same are regularly despatched.

(5) Profit and loss accounts to be made up and such dividends as the directors may decide paid *half-yearly* to the shareholdres.

This is roughly a scheme that I feel might be speedily and easily put in force. I am aware that it is a matter for the people themselves, but I think the Government might assist in reducing initial cost by arranging to erect the central depots at a moderate rental. I have spoken to several of the leading farmers, and they would be prepared to take up shares in such a co-operative scheme; there is practically no limit to the supply, provided there were facilities of output, but the chief difficulty among a rural community is *initiative.* Such a scheme would do much to render life more bearable to the farmers by bringing producer and consumer together, so paving the way to the prosperity of our country districts, and, at the same time, benefiting the urban communities.

Yours, etc.,

Hekpoort. E. LUKE FREER.

* * * *

PRESERVATION OF MILK.

To the Editor of the Agricultural Journal.

Sir,—I take the liberty to apply for the kind favour of advice how to deal with milk which I want to send from here to Lourenço Marques for consumption there, fresh.

It would be milked at about 6.30 p.m.; railed at about 8.30 p.m.; reach Lourenço Marques at 6 a.m.

I could send it either:

(1) In the usual dairy tin cans (5 gallons); could provide a woollen jacket for wetting—but this would soon be dry—before, in fact, the milk (canned warm from the cows) could be properly cooled.

(2) In the ordinary disc-covered glass bottles, one-sixth gallon each.

Up to the present, experiments made by others showed that milk could not always remain fresh enough for consumption the morning of arrival at Lourenço Marques, especially if travelling on sultry nights; chemical preservations were also used without avail; but I could not find out what remedies were employed—boric, salyl, formaic or other.

There are no refrigerators available.

Perhaps you can give me a recipe of a chemical that can be honestly declared as innocuous even to infants copiously consumed, and the exact quantity to be used per gallon.

Yours, etc.,

Belfast. C. H. THOMAS.

Answer: Your enquiry, addressed to the Editor, "Agricultural Journal," with reference to the treatment of milk for forwarding to Lourenço Marques has been sent to me for attention, and I have the honour to reply as follows:—

Under such conditions, the most satisfactory method of treatment to adopt consists in first Pasteurising the milk, then cooling it to nearly freezing point with the use of refrigerating machinery, and, finally, despatching it in cans containing either a column with ice inside, immersed in the milk, or a wet jacket of canvas or woollen material around the tins, or both.

Considerable quantities of milk would, however, require to be handled to repay the expenditure involved in such treatment, and herein lies the value of having a co-operative dairy in a district, which dairy could receive the supplies of many dairymen, and with profit and advantage treat the milk on the most approved principles for such a supply as that under consideration. I gather, however, from your letter that such means of treatment are not within your resources, and, if such is the case, I would recommend you to treat the milk as follows:—

Immediately after milking, and before the milk is allowed to stand for even a few minutes in the cow byre, pass it over a refrigerator (after being thoroughly strained), using plenty of water of the coldest supply available. This will reduce the temperature of the milk to nearly that of the water, and remove animal odours. From the refrigerator let the milk run into the cans in which it is to be despatched. Next stand these cans in tubs containing newly-made brine, and let them remain there for an hour or two, or until the temperature of the milk in the cans is nearly the same as that of the brine. This operation will have the effect of further reducing the temperature after refrigerating. Then place around the cans a thick woollen jacket or other material which will absorb a lot of water.

Refrigerators for use on farms can be obtained at a reasonable cost from suppliers of dairy machinery in the country. Too much importance cannot, however, be made of exercising the greatest care in the treatment of the cows, and the strictest cleanliness throughout every operation, and in all dairy utensils. These and other points in detail are treated in the bulletin on "City and Town Milk Supply and the Care and Aeration of Milk," a copy of which is enclosed.

With reference to the use of chemicals as preventatives, I cannot, from a hygienic standpoint, countenance or recommend their use.

ALEX. HOLM,

General Manager, Potchefstroom Experimental Farm.

DESTRUCTION OF SEEDS BY MICE AND RATS.

To the Editor of the Agricultural Journal.

Sir,—I should be glad if you could advise me as to the best methods for preventing mice and rats from picking out and eating newly planted seeds, especially cucumber, water melon, and pumpkin seeds. I have tried steeping the seeds in a "solution of arsenic," "coal tar," "Stockholm tar," "McDougal's dip," "Paris green," and "red lead," the last of which I have found the best, but not by any means a sure preventive. The seed I covered with Paris green, I wet the seeds and put them in a tin with a little "Paris green" and shook them up, and not a single one of them has germinated.

Yours, etc.,

"Macsvale," Barberton. W. P. G. MACPHERSON.

Answer: I do not think that the treatment of the seeds with arsenical *solutions* is advisable, as these substances are plant as well as animal poisons. Perhaps the use of *insoluble* arsenic compounds, *e.g.*, lead arsenate, might be successful in destroying the animals without injuring the seeds which were not eaten.

But I am inclined to think that the best plan would be to attempt to destroy the vermin independently of the seed. This could probably be best effected by means of phospherous paste mixed with oatmeal and placed round the seed beds, or, in default of that, by grain, oats or barley previously steeped in a strong solution of strychnine for 12 hours.

I need hardly emphasise the necessity of the utmost care in handling such extremely poisonous substances in order to avoid accident. The destruction of the rats and mice in the neighbourhood of your seed beds could also be aided by the use of suitable traps.

H. INGLE,
Chief Chemist.

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To the Editor of the Agricultural Journal.

Sir,—A friend has just given me one of your "Agricultural Journals" (October, 1906). It is, in my opinion, a very valuable paper, and if it is regularly supplied with such practical articles as this one contains, it should prove a boon to your Colony.

I am an agricultural farmer and have travelled through Nebraska and many of the semi-arid regions of the Western States. Your article on lucerne growing there is good—it is known as the "Bond-lifter" in most of the Western States. Since my visit to the West I have increased my lucerne fields, and will, in a year or two, have 200 acres of well-established lucerne. If our farmers would begin to carefully conserve all flood water, as they do in the arid regions

of America, and use their fodder for winter use, we would become less dependent on foreign markets year by year.

Yours, etc.,

Poplar Grove, J. B. LEACH.
Queenstown, C.C.

* * * *

SNAKE BITES.

To the Editor of the Agricultural Journal.

Sir,—I am very much troubled by snakes on my farm; yesterday the boy informed me that one of my valuable sows was bitten by a snake and died shortly afterwards. One of my young bulls was also bitten by a snake, but I do not know whether it is still alive.

In order to prevent further damage, it is advisable to have them killed whenever the opportunity offers itself, but as a snake in the grass is a difficult object to observe, and one generally meets these reptiles at a moment when least expected, it would be beneficial to have a little information from you on the subject, its mode of life, the most common kind, and the most venomous kind found in the Transvaal.

Your advice as to how to act when either man or beast is bitten, and the antidote recommended, I shall esteem as a great favour.

A neighbour of mine says: Give the animal bitten bottle of brandy at intervals, or bottles of salt water frequently, and cover the place that shews the bite of the reptile with a mixture of "blue" and vinegar.

Is this correct?

Do you know better antidotes?

What to do when human beings are bitten?

In fact, if not too late, could you give us a small article of the most important points in your next issue?

Is there a domestic animal that destroys snakes?

Do you know of anything that will attract them to a certain spot like a piece of cheese in a mouse trap or some chemical in bait as for fishing?

I am unpleasantly concerned about this matter, and as we intend shortly to live there, it is a most uncomfortable sensation to be advised of a danger for which we regret we have no information or knowledge how to act when confronted with such a situation.

I have little children who will roam during the holidays over the farm, and it is needless to say that your valuable advice will greatly oblige.

Yours, etc.,

Johannesburg. MARTEN MULDER.

Answer: The Editor of the "Transvaal Agricultural Journal" has handed me your letter of the 20th inst. for reply.

It is very difficult to recommend any quick method of ridding your farm of snakes. The best method will probably be to employ

a man to look for and kill the reptiles, which can frequently be found under large stones or in old termite heaps. When collecting for our Museum I always look for them in such places. A blow with a stick across the back usually renders them unable to strike, and they can then be killed in perfect safety. I do not know of any way of attracting snakes by bait, nor of any trap to catch them with.

You ask whether any domestic animals attack snakes. It is commonly asserted that pigs will attack, kill and devour poisonous snakes (for instance, they are said to attack rattlesnakes in the United States), but I have personally never seen them do so. Of course, several wild animals eat snakes, some of which might be tamed and kept for the purpose, for instance, hedge-hogs, mongooses (muishond), secretary birds, etc.

Not being a medical specialist, I cannot presume to recommend any remedies for snake bite, nor to discuss the relative value of various antidotes. However, when out collecting, I always carry a small quantity of permanganate of potash with me; should I be bitten by a snake I would first make a deep gash across the wound and then push in some of the crystals of permanganate. As far as I know, this is the remedy recommended by the Indian Government. Brandy or spirits taken in large quantities are also recommended by many people. The treatment for animals is probably the same as for human beings.

It is my intention in the next numbers of the "Agricultural Journal" to give a popular description and photographs of the various species of snakes found in the Transvaal, and I hope that the articles will be of use to you and to all other farmers troubled by snakes. Might I request you to co-operate with me and help me by sending all snakes caught or killed on your farm to our Museum?

Yours, etc.,

Transvaal Museum,
Pretoria.

LEWIS H. GOUGH, Ph.D.,
Zoologist.

DEPARTMENTAL NOTICES.

AVAILABLE PUBLICATIONS.

The following publications, amongst which are included several recent additions, can be had free of charge on application to the Government Printer, Box 373, Pretoria :—

Transvaal "Agricultural Journal," No. 3, Vol. I. (Published quarterly)
Transvaal "Agricultural Journal," No. 4. Vol. I. " "
Transvaal "Agricultural Journal," No. 5, Vol. II. " "
Transvaal "Agricultural Journal," No. 10, Vol. III. " "
Transvaal "Agricultural Journal," No. 13, Vol. IV. " "
Transvaal "Agricultural Journal," No. 14, Vol. IV. " "
Transvaal "Agricultural Journal," No. 15, Vol. IV. " "
Transvaal "Agricultural Journal," No. 16, Vol. IV. " "
Transvaal "Agricultural Journal," No. 17, Vol. V. " "

Division of Botany:
- Leaflet No. 1.—"Plants Poisonous to Stock."
- Leaflet No. 4.—"The Cockle-Burr" (English and Dutch).
- Bulletin No. 1.—"Conditions of Seed and Plant Distribution."

Division of Entomology:
- Leaflet No. 2.—"Orange Tree Butterfly" (English and Dutch).
- Leaflet No. 3.—"White Ants" (Dutch).
- Leaflet No. 4.—"Locust Report, July, 1906" (Dutch).

Division of Forestry:
- "Price List of Seeds and Trees" (English and Dutch).

Division of Horticulture:
- Bulletin No. 1. "Some Information about Fruit Trees" (English and Dutch).
- Leaflet No. 1. "On Summer Pruning" (English and Dutch).
- Leaflet No. 2. "On Thinning Out Fruit."
- Leaflet No. 3. "A Fruit Report" (English and Dutch).
- Leaflet No. 4. "Diseases of Orange Trees" (Dutch and English).

Division of Publications:
- Bulletin No. 1.—"Burr-Weed or Boete Bosch."
- Bulletin No. 2.—"Some Diseases of the Horse."
- Bulletin No. 3.—"The Food of Plants."
- Bulletin No. 6. "City and Town Milk Supply and the Care and Aeration of Milk" (English and Dutch).

Division of Veterinary Science:
- Bulletin No. 1.—"Measles in Swine and Cattle" (English and Dutch).
- Bulletin No. 3.—"Redwater" (Dutch).
- Bulletin No. 4.—"Epizootic Lymphangitis."
- Bulletin No. 5.—"Scab and its Eradication."
- Bulletin No. 6.—"Contagious Abortion" (English and Dutch).
- Leaflet No. 3.—"Rhodesian Tick Fever" (English and Dutch).
- Leaflet No. 4.—"Directions for preparing Blood Smears."

Miscellaneous:
- Transvaal Forest Report.
- Agriculture within the Empire.
- Bulletin No. 1.—"The Brands Directory, 1904" (English and Dutch).
- Bulletin No. 2.—"The Brands Directory, 1905" (English and Dutch).
- Bulletin No. 1.—Department of Irrigation and Water Supply: The Design and Construction of Small Reservoirs for Irrigation and for Stock.
- Bulletin No. 2.—Department of Irrigation and Water Supply: The Design and Construction of Small Irrigation Canals.

JOURNAL FILES.

In order that our numerous readers may not be disappointed by being unable to complete their files, we would earnestly request them to preserve all copies of the "Journal," if they propose to bind them at the close of the year. Owing to the expense incurred in publication, it has become necessary to limit the number of copies issued, and it often happens that we cannot supply back numbers, as they are out of print.

Indices for the "Agricultural Journal," Vol. I., Vol. II., Vol. III. and Vol. IV. can be had on application to the Department of Agriculture.

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JOURNAL DUPLICATES.

Any readers who possess and can spare duplicates of the "Agricultural Journal" would confer a great favour by returning them to the Department of Agriculture, as back numbers are now out of print, and applications are constantly being made by persons desirous of completing their sets.

* * *

ADDRESS.

Correspondents are earnestly requested to give their full name and correct postal address when forwarding any communication to the Department. It sometimes happens that readers send their farm address only, and fail to give the Post Office address, consequently it is impossible to reply to their queries or send publications. This refers more especially to farmers applying for cattle permits, as in many cases letters forwarded by the Veterinary Division are returned by the Postal Authorities to the effect "Not delivered, Address insufficient." The Department should also be immediately notified of any change of address.

* * *

APPLICATIONS FOR THE JOURNAL AND NON-DELIVERY.

Applications to be placed on the Mailing List of the "Journal," as well as complaints as to non-delivery of the "Journal," should be addressed to the Government Printer, P.O. Box 373, Pretoria, and not to the Editor of the "Journal." It is particularly requested that changes of address should also be promptly notified to the Government Printer, in order to ensure prompt delivery to addressees and to avoid unnecessary correspondence.

The "Agricultural Journal" is distributed free in the Transvaal only, and the attention of subscribers in the other South African Colonies and Oversea is kindly requested to the Government Printer's Notice on the tinted page at the commencement of this number.

* * *

* GOVERNMENT STALLIONS FOR PUBLIC STUD.

Applications to hire stallions for next season should be made before July 15th, on which date these applications will be considered.

As the number of stallions is limited, preference will be given to owners of the best class of mares.

TERMS.

Stallions will be leased to individuals, associations, or two or more breeders in conjunction, approved of by the Department.

The Lessee or Lessees to allow the farming public to send mares for service at a fixed fee, provided the list is not already full, the fees to be according to the following tariffs, viz. :—

Prices paid for hire of Stallion.	*Fee to be charged by Lessee not to exceed*
£25	30s.
£30	35s.
£40	45s.
£50	55s.
£60	65s.

The charge for the hire of the majority of the stallions will range from £25 to £35, but for a few exceptionally high-class animals somewhat higher rates will be made.

Payment for hire of stallions to be made in advance.

Not more than 40 mares to be served by a stallion without written permission.

*This notice has already appeared in the daily press.—*Editor.*

Stallions will be delivered by the Department at the nearest railway station to the place where they are to stand at stud, and expense of railage will be borne by the Department. At the termination of the season the stallion will be taken over by the Manager of the Government Stud Farm, or his representative.

Stallions will not be allowed to run with mares unless by special arrangement.

Due care must be taken that stallions shall not serve mares suffering from any contagious diseases.

The Manager of the Stud Farm or his representative to have the right to inspect the stallions leased at any time.

In the event of a stallion dying during the period for which he has been leased, from any cause through which the lessee is to blame, the lessee will be liable for a sum equal to the price already paid for the hire of same.

The lessee to be responsible for the good care and attention of the stallion and his equipment.

Should any of the foregoing rules not be complied with, the Department shall have the right to remove the stallion at once, and to take any action desirable for the recovery of damages, the lessee to forfeit the money paid for hire.

Applications must be addressed to the Manager, from whom any further information can be obtained.

F. B. SMITH, Director of Agriculture.

A. McNAE, Acting Manager.

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DIVISION OF FORESTRY.

TARIFF FOR POLES AND FIREWOOD FROM GROENKLOOF PLANTATION, PRETORIA.

It is notified for general information that the Groenkloof Plantation having been transferred to the Municipality, all applications and correspondence in connection therewith should be addressed to the Town Engineer, Pretoria, and not to the Department of Agriculture.

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PRICE LIST OF TREES AND SEEDS.

The price list of trees and seeds supplied by this Division, which was printed in full under "Departmental Notices" in the last number of the "Journal," has now been issued as a separate publication, and can be obtained free of charge on application to the Conservator of Forests, or the Government Printer, Pretoria.

* * *

NOTICE No. 542 OF 1906.

GRANTS-IN-AID OF TREE PLANTING.

It is hereby notified that the Government is prepared to contribute towards the expenses of Tree Planting, undertaken by Municipalities, Agricultural Societies, and other Public Bodies.

The conditions under which the grant will be made are:—

(1) There shall be submitted to the Director of Agriculture for approval, as soon as possible after the 1st of July in each year, a plan of the place or places or streets where it is intended to plant, a list of the kinds of trees to be planted, and also an outline of the methods to be employed in preparing the ground for the trees and for protecting them. The total number of trees to be planted and the total estimated cost should be stated.

(2) The completed work shall be inspected and compared with the approved working plan, and for any unauthorised departure from the plan submitted to be approved by the Director of Agriculture a deduction may be made from the expenditure account.

(3) Street trees shall not be planted on the pavement or furrow or be spaced nearer than 15 feet apart. They must be securely fenced.

(4) Different kinds of trees shall not be mixed.

(5) Plantations shall be protected against fire.

(6) A separate account shall be kept of all monies expended on tree planting, and shall always be open for Government inspection, and a statement of accounts signed by the Chairman and Secretary and countersigned by the local Magistrate shall be submitted to the Director of Agriculture not later than the 1st of June in each year, so that the grant may be paid before the end of the financial year (June 30th).

(7) On approval of the Director of Agriculture, or his Deputy, of the work undertaken, and of the accounts for the same, a sum (not exceeding £100 for any one body) equal to half the total expenditure incurred in tree planting shall be refunded to the Municipality, Agricultural Society, or other Public Body concerned.

(8) As the money available for this scheme is limited, applications will be dealt with in the order in which they are received, till the whole sum has been allotted.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture,
Department of Agriculture,
Pretoria, September, 1906.

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DIVISION OF BOTANY.

SEED DISTRIBUTION.

A list of seeds available for farmers who are willing to conduct experiments in co-operation with the Division has been published as Bulletin No. 1, and may be obtained on application to the Government Printer. Terms on which the seeds will be issued are stated in the Bulletin, and application forms will be found within the cover. Notes are given as to the uses of the plants and as to how the seed should be treated.

COCKLE-BURR.

On account of the dangerous character of this weed to wool and mohair growers, farmers on the Aapjes, Pienaars and Crocodile Rivers, are advised to keep a sharp look-out for its appearance, especially on the banks of the rivers, and to root out the plants before they go to seed. Any farmer who is in doubt as to the identity of Cockle-Burr can send specimens to the Botanist for identification.

* * *

DIVISION OF CHEMISTRY.

INSTRUCTIONS FOR THE SAMPLING OF SOILS.

In taking soil for analysis it is of the utmost importance that a truly representative sample be secured, otherwise the labour involved will, to a great extent, be wasted.

Much depends upon the particular object for which the analysis is to be made. If the soil of a farm or field is to be reported upon, and much difference exists in the soil from different parts, each variety of soil should be represented in the final sample by a quantity proportional to the aliquot portion of the whole area covered by that particular soil.

If great differences are known to exist in different parts of the farm or field better knowledge of the nature of the soil will be obtained, of course, at the cost of greater labour in analysis, if the samples are kept separate.

The *depth* to which a sample is taken is also a matter of importance. In some cases a clear line of separation between the soil proper and the sub-soil is perceptible. This is often shown by difference in colour, the soil being richer in organic matter, and therefore darker than the sub-soil. Under such circumstances the sample of soil should be taken down to the line, and, if necessary a sample of sub-soil should also be secured. When no distinction is perceptible, the sample should be taken to the depth of one foot.

METHODS OF TAKING SAMPLES.

There are many ways of taking samples of soil. The following, perhaps, will be found most convenient in this country :—

(1) Having selected a representative spot, the vegetation upon it is removed, and a hole is dug with a sharp spade to a depth rather greater than that of the soil proper, or, if no line of separation of soil from sub-soil is perceptible, to about 15 inches. One side of the hole is then trimmed with the spade so as to be smooth and vertical, the hole being cleaned out. A slice of uniform thickness, about 3 or 4 inches, is then removed by the spade down

to the necessary depth. This slice is placed on a clean board or sack and mixed with similar slices, obtained in the same way from other parts of the field. Finally, all the samples are thoroughly mixed together with the trowel or the spade, the sticks, large stones, and roots removed, and a portion of six or seven pounds placed, with a label giving details, in a clean box and sent for analysis.

(2) Another, better but more laborious, method is to have wooden boxes, six inches square and 12 inches deep, to hold the samples. A large hole is dug with a spade at the selected spot, and a square upright block of soil is left in its centre. This is carefully trimmed with the spade until a box will just fit over it. The upper surface of the block of soil is freed from vegetation, the box inverted over it, and forced down. The spade is next slipped under, and the box with its contents removed, a label giving particulars of the soil put in, and the lid screwed on. In this way a sample of the soil (and often the sub-soil, *in situ*) is obtained, which can be examined in the laboratory.

What to do with the Samples.

In all cases full details as to the exact locality, date of collection, depth, crops borne, previous manurial treatment, and other circumstances connected with the soil should be enclosed with the sample. These should be written in pencil, as ink is apt to become damp and run.

Samples should be sent by passenger rail, addressed to me at the Agricultural Chemical Laboratories, Pretorius Street, Pretoria, and advice of their despatch together with details of the samples, should be sent by post to the same address.

While every effort will be made to deal with the samples as soon as possible, for a time, at least, some delay may be unavoidable, owing to the large accumulation of material awaiting analysis. *No attention will be paid to samples sent without the full details stated above.*

A list of charges for the analysis of soil and other products is published below, but in cases where it is considered that the results may be of sufficiently general interest, if published, no charge will be made.

Herbert Ingle,
Chief, Division of Chemistry.

* * *

SCHEDULE OF CHARGES FOR ANALYSIS MADE IN THE AGRICULTURAL LABORATORIES.

		£	s.	d.
1.	Estimation of one constituent in a manure or feeding stuff ..	0	7	6
2.	Estimation of two or three constituents in a manure or feeding stuff ..	0	15	0
3.	Complete analysis and valuation of a manure or feeding stuff ..	1	0	0
4.	Analysis of water—drainage or irrigation ..	1	5	0
5.	Partial analysis of a soil to determine fertility and manurial needs ..	2	0	0
6.	Complete analysis of a soil ..	3	0	0
7.	Analysis of milk, cream, butter, or cheese ..	0	10	0
8.	Milk—determination of fat and total solids ..	0	5	0
9.	Milk—determination of fat only ..	0	2	6
10.	Butter—determination of water and fat ..	0	5	0
11.	Analysis of a vegetable product—hay, ensilage, roots, etc. ..	1	0	0

At present no charge will be made to *bona fide* farmers. The charges in the above schedule refer to products sent by manure merchants, milk dealers, or others interested in trade. Samples will only be accepted if assurance can be given that they are properly taken and truly representative of the bulk. The right of publishing the results of any analysis is reserved by the Department. Should the examination of any product furnish results which are deemed of sufficient general interest, the charges may be remitted.

Samples of any product likely to be of agricultural importance will gladly be received.

* * *

SPONZIEKTE OR QUARTER EVIL.

Vaccine for the prevention of this disease is now ready for issue at the Government Veterinary Bacteriological Laboratory, and can be obtained through the Government Veterinary Surgeons, who will give instruction in the method of vaccination, and through whom also the necessary instruments can be obtained. The price of the vaccine is 3d. per double dose.

LIST OF OFFICIALS.

The following is a list of the officials of the Transvaal Department of Agriculture, to whom inquiries respecting matters connected with agriculture may be addressed :—

Director .... F. B. SMITH
Assistant Director .... A. C. MACDONALD
Division of Veterinary Science :
(a) Bacteriology .... A. THEILER
(b) Contagious Diseases .... C. E. GRAY
Division of Chemistry .... HERBERT INGLE
Division of Botany .... J. BURTT-DAVY
Division of Forestry .... CHARLES E. LEGAT
Division of Entomology .... C. B. SIMPSON
Division of Horticulture .... R. A. DAVIS
Division of Publications .... WILLIAM MACDONALD
Division of Poultry .... REGINALD BOURLAY
Tobacco Division .... J. VAN LEENHOFF
Government Stud Farm, Standerton .... A. MCNAE
Government Experimental Farm, Potchefstroom .... ALEXANDER HOLM
Government Experimental Farm, Ermelo .... H. NICHOLSON
Translator .... OTTO MENZEL
Registrar of Brands .... J. J. PIENAAR

* * *

ASSISTANCE IN IMPORTATION OF BREEDING STOCK.

Notice is hereby given that with the object of encouraging the importation of breeding stock into the Transvaal Colony the Government is prepared to grant assistance to *bona-fide* farmers as follows :—

1. A grant, not exceeding £20 to any individual, towards defraying half the cost of railage from any station in South Africa to any station in the Transvaal on sheep and Angora goats imported solely for breeding purposes and being the property of the applicant.
2. Claims to be supported by a duly receipted voucher of the Railway Department at place of entraining.
3. Applicants for this refund to undertake to preserve and maintain the said stock for a period of not less than two years from date of payment of the grant.
4. Applicants must agree not to sell, or otherwise dispose of, or slaughter any of the stock without the permission of the Commissioner of Lands. Permission to slaughter to be given only in the event of the stock proving incapable of breeding.
5. Failing the faithful observance of the conditions the Commissioner o Lands shall call upon the farmer for an immediate refund of the grant
6. In cases of dispute the decision of the Commissioner of Lands to be accepted as final.
7. Applications for the grant to be made through the local Magistrate or Resident Justice of the Peace, who will furnish a form to be completed and forwarded to the Director of Agriculture for consideration.
8. If desired the stock can be carried on any of the South African Railways at the expense of the Government provided an amount equal to half the cost of such railage be first deposited with the Director of Agriculture.
9. As the amount of these grants is limited to the sum of £3,000 in the present financial year, applications will be dealt with in the order in which they are made.

F. B. SMITH,
Director of Agriculture.

Department of Agriculture,
Pretoria. 31st October, 1905.

SUMMARY OF DEPARTMENTAL INSTRUCTIONS FOR THE GUIDANCE OF STOCK INSPECTORS AT TRANSVAAL PORTS OF ENTRY.

(Animals will be inspected only between the hours of sunrise and sunset.)

No. 1.—Cattle.

No cattle will be admitted into the Transvaal by road or rail unless the owner has previously applied for and obtained a written permit from the Department of Agriculture, Pretoria. This permit must be presented to the Stock Inspector along with the animals at the Ports of Entry specified in the permit.

In making application for this permit the following particulars must be furnished :—Name of owners ; locality from which the cattle come ; purpose for which they are being introduced ; number of animals to be introduced (if coming by; rail station at which they are to be trucked ; station at which they are to be derailed) ; name of consignee and ultimate destination of the animals. These particulars are required for the information of the Advisory Committee of the Ward or District into which the cattle are to be introduced, by whom all permits have to be recommended before they are issued.

SLAUGHTER CATTLE will be branded at the Port of Entry with the brand S on the left side of the neck before proceeding to their destination if this has not been already done by the consignor before shipment.

No. 2.—Equines.

All persons introducing equines into the Transvaal must produce certificates for their animals signed by a qualified Veterinary Surgeon holding the Diploma of the Royal College of Veterinary Surgeons, England, stating that the animals are free from disease and that they have been tested with mallein and have reacted in a normal manner. These certificates will be collected by the Stock Inspector at the Port of Entry. If any horse is presented for admission without a certificate it will either be tested with mallein by the Stock Inspector and allowed to enter after the Inspector is satisfied that the animal is free from disease, or it may be allowed to proceed to its destination and tested there, whichever course is most convenient for the Department.

Exceptions.

Equines which are engaged in to and fro movements across the border. Equines which have recently come from the Transvaal and are returning thither.

Racehorses in training will be allowed to proceed to their destination upon the owner giving an undertaking to report their arrival to the Government Veterinary Surgeon of the District, and to submit the imported animals to the mallein test if the Government Veterinary Surgeon considers this necessary. All other equines will be detained and tested unless the owner has previously made other arrangements with this Department.

No. 3.—Sheep.

Sheep are subject to examination at the Port of Entry and liable to detention if found affected with scab.

No. 4.—Pigs.

Pigs from Cape Colony are now allowed to enter the Transvaal if the following conditions are observed :—The person desiring to introduce swine into this Colony from Cape Colony shall make application to the Director of Agriculture, Pretoria, stating the place from which and the person from whom the swine are being obtained, and giving particulars as to their number, destination, and the purpose for which they are being introduced ; he shall further submit with such application a certificate signed by the Chairman of local authority of the district from which the animals are to be brought and endorsed by the Chief Veterinary Surgeon or his representative to the effect that such swine are free from swine fever, and that there has been no swine fever in the place from which they have been immediately obtained.

Upon receipt of such documents the Director of Agriculture may grant and transmit a permit authorising the introduction of such swine. Such permit shall be sent with the animals, and shall be handed over to the Stock Inspector at the Port of Entry.

Permits for the introduction of pigs from other Colonies are not required.

C. E. GRAY,

Principal Veterinary Surgeon.

GOVERNMENT STUD FARM, STANDERTON.

Horse Breeding. Season, 1906–7.

Mares may be sent to the Thoroughbred Stallions that are standing at the Government Stud Farm during the present season.

Mares can remain on the Farm during the season if their owners wish them to do so. (This arrangement will be of especial value to Mares from Horse Sickness Districts.)

Charges: For Grazing Mares 5s. per month. For Stabled Mares 1s. per day. Inclusive of attendance.

Mares will receive every care and attention, but no liability can be accepted.

Stud cards, giving Stud Fees and particulars of the Stallions, may be procured from the Manager, from whom any further information can also be obtained.

Postal Address:
A. McNae,
Acting Manager, Government Stud, Standerton.

Telegrams:
"Horses,"
Standerton.

Special Railway Rates.

Mares that have been sent from any railway station in the Transvaal to the Government Stud Farm, Standerton, will—if returning to the same station within a period of three months—be carried over The Central South African Railways free of charge, on production of a Certificate signed by the Manager, Transvaal Government Stud, stating that the Mares have been to the Farm for Breeding purposes.

Mares will be met at Standerton provided two days' clear notice of the time of their arrival is sent to the Manager of the Stud Farm.

F. B. SMITH,
Director of Agriculture.

* * *

NOTICE.

It is hereby notified for general information that the Department has been advised by the Commissioner, Nairobi, British East Africa, that sheep and goats may now be imported from the South African Colonies into British East Africa if accompanied by a Veterinary Certificate certifying that the animals are in good health.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture,
Pretoria, October 1st, 1906.

* * *

POISONOUS PLANTS.

The Division of Botany and Division of Veterinary Science are carrying on a series of joint investigations on the poisonous plants of the Colony, their effect on stock, and the remedies to be applied.

Last year we invited farmers to send specimens of poisonous plants for identification, and are glad to be able to extend the invitation this year.

Any farmer who has poisonous plants on his farm, and would like information about them, may send samples to the Department for investigation. These samples will be identified and named, will be tested on animals kept for the purpose, the symptoms will be carefully diagnosed, and different remedies will be tested. A report of the results will be sent to the person furnishing the specimens.

For an effective test, samples of at least 5 lbs. of the material should be sent, but smaller samples will also be welcome for identification and preliminary report.

Through the courtesy of the Postmaster-General, specimens may be sent by post, free of charge, if fastened up as letters and addressed:—

O.H.M.S. Letter Post.
The Government Botanist,
Department of Agriculture,
P.O. Box 434,
Pretoria.

CO-OPERATIVE EXPERIMENTS: COTTON.

COTTON-SEED DONATED BY THE BRITISH COTTON GROWING ASSOCIATION.

The Department has received a large consignment of American Upland Cotton Seed from the British Cotton Growing Association. This seed will be distributed to any *bona-fide* farmer who wishes to give the crop a trial, in sufficient quantity to sow one acre (209 x 208 English feet).

The amount of seed required will be as follows:—

For the Lowveld, sowing 4 x 3 feet, 3 lbs. of seed.
" Middleveld " 4 x 1½ " 5 to 6 lbs. of seed.
" " " 4 x 1 " 7 to 9 " "

(the thicker sowing is advisable at higher altitudes where the climate is rather cooler).

The farmer is required to pay all carriage and transport charges from Pretoria to his farm (freight from America to Pretoria has been paid by the Association and the Department).

The farmer must sign and return the attached form of agreement either to the Government Botanist or to the Resident Magistrate.

This agreement is made necessary by the conditions under which the Association has supplied the seed. These conditions read: "That all the cotton grown from this seed shall be shipped to the Association for sale, and if the experiment proves successful the cost of the seed shall be refunded to the Association, that other experiments may be conducted; . . . "if the experiments are a failure they (the farmers) will be called upon to pay nothing; if successful, the Association will dispose of the Cotton for their account, and deduct the cost from the proceeds."

The Association has agreed to supply the Department with two hand-gins, which we intend to loan out to each distrct. Application for the use of these gins should be made in due course to the Resident Magistrate.

A pamphlet entitled "Hints on the Cultivation and Harvesting of Cotton," has been issued by the British Cotton Growing Association; a few copies are still available, one of which will be sent to each farmer receiving seed, as long as the supply holds out.

For further information on Cotton Cultivation, etc., growers are referred to the articles and notes which have appeared in the *Transvaal Agricultural Journal* during the last 18 months, particularly the following:—

Cotton Growing in the Transvaal: *Agricultural Journal* No. 12, p.p. 739–745. (July, 1905.)
Cotton as a Possible Crop for the Transvaal: No. 8, pp. 595–599. (July, 1904).
How to Estimate the Yield of Cotton-lint per Acre: No. 9, p. 174.
Weight of a Bale of Cotton: No. 9, p. 174.
Transvaal Cotton; Reports from the Imperial Institute: No. 9, pp. 136–137; No. 11, pp. 554–556.
Cotton in South Africa: No. 9, pp. 130–131.
Transvaal Native Cottons: No. 9, p. 131 and pp. 136–137.
Cotton in the Lowveld of the Eastern Transvaal: No. 10, p. 316.
Zoutpansberg Cotton: No. 9, pp. 136–137; No. 11, p. 554.
Swaziland Cotton: No. 9, p. 137.
Cotton in the Marico and Rustenburg Districts: No. 12, pp. 863–864 and 842.
Cotton at Malelane: No. 13, October, 1905, p.p. 152–155.

JOSEPH BURTT-DAVY,
Government Agrostologist and Botanist.

THE GOVERNMENT AGROSTOLOGIST AND BOTANIST,
TRANSVAAL DEPARTMENT OF AGRICULTURE,
P.O. Box 434,
PRETORIA.

CO-OPERATIVE EXPERIMENTS: COTTON.

SIR,

Please forward me by *.. ..
carriage forward, to..Station, in
care of..., Forwarding
Agents, ...lbs. of Cotton seed.

I agree to furnish you with a full and accurate report, at the end of the season, as to the results of the experiment, on the forms to be supplied by you.

* State whether the seed is to be sent by Passenger or Goods Train or by Parcels Post. (If it is to be sent by Post, 8d. per lb. for postage should be enclosed with the application.)

In the case of the experiment being successful, I also agree to ship the whole of my crop of Cotton to the British Cotton Growing Association for sale, and I will allow the aforesaid Association to deduct the cost of the seed from the proceeds thereof.

Date..

Sign here..

Two witnesses. ....

....

Full P.O. Address ....

....

* * *

GOVERNMENT NOTICE No. 242 of 1906.

Grants-in-Aid of Agricultural Societies and other Similar Organisations.

Notice is hereby given that for the purpose of assisting Agricultural Societies and other organisations formed for the promotion of the agricultural industry, the Government will be prepared to make grants-in-aid to such societies on the following conditions :—

1. Ten shillings for every £ raised by subscriptions, donations, and gate money, the proceeds of which are devoted to the ends specified above. No grants to be made against "value" contributions.
2. Special grants, when funds are available, against the costs actually and *bona-fide* incurred in the future construction of buildings on, or other permanent improvements to, agricultural societies' grounds, provided that such buildings or improvements remain unalienated and vested in the Chairman or Secretary as trustee of the subscribers.
3. The Registrar of Deeds will be notified of all grants made under Clause 2, and will register same against the transfer of the property concerned.
4. The grants will be subject to the approval of the Commissioner of Lands, who will deal with the applications as they are received, fixing a maximum sum to be granted, if he deem necessary, having regard to the funds at his disposal, and the needs of the society concerned.
5. The Commissioner of Lands may alter the conditions under which any grant is made when, in his opinion, it is desirable to do so.
6. Grants will be paid annually on production of a statement of receipts and expenditure signed by the Chairman of the society or club, and bearing a certificate as follows :—

> "I hereby declare the above to be a true and faithful statement of the receipts and expenditure of the................during the period from............to............and that no grant has already been claimed from the Government in respect of any portion of the receipts here shown."

Such declaration to be made before the local Magistrate or Resident Justice of the Peace, and who will also declare as follows :—

> "I certify that to the best of my knowledge and belief the above statement is correct and that the society is entitled to a grant from Government under the conditions laid down in Government Notice No. 242 of 1906."

7. Claims intended for payment before the end of each financial year should be submitted not later than the 30th April.

They must be in respect of subscriptions and donations, etc., received during the twelve months ending on the 31st March of each year, and not prior to the commencement of that period, unless no claim has been made in the previous year.

8. Applications for grants should in all cases be forwarded through the local Resident Magistrate or Resident Justice of the Peace.
9. Copies of the audited balance sheet and the annual report of the society or club should be forwarded to the Department of Agriculture as soon as published.

A. C. MACDONALD,
Acting Director of Agriculture.

Office of the Director of Agriculture,
Pretoria, 5th March, 1906.

EXPERIMENTAL FARM, POTCHEFSTROOM.

Stock and Seeds for Disposal.

Pigs.

Pure-bred boars and sows about 4½ months old of the following breeds:--Large White Yorkshire, Tamworth, and Large Black. Price 50/- each, f.o.r. Potchefstroom.

Seeds.

Limited quantities of the following seeds are available for disposal. The quantity to be allotted to each applicant will be determined by the orders received, and in the case of shortage preference will be given to applications in order of their priority:--

Wheat.

Price 12/- per 100 lbs., f.o.r. Potchefstroom.

Variety.	*Remarks.*
New Era	Red, Late and Bearded.
Red King	Late and Beardless.
Red Stand Up	Do.
Rough Chaff White	Do.
Red Nursery	Do.
Fourie	Early, White and Bearded.
Rietti	Early, Red and Bearded.
New Zealand Red	Early, Red and Bearded.
White (local)	Early and Beardless.

The varieties termed Late are Heavy Cropping winter varieties and very hardy against frost. They should be sown early.

Oats.

For "Oat-forage" or "Oathay."

Price 12/- per 100 lbs., f.o.r. Potchefstroom.

Variety.	*Remarks.*
Winter (English)	Late, Heavy Cropper of excellent quality. Should be sown early.
White Egyptian	Early.
Algerian	Early.
"Cape"	Early.
"Boer"	Very early. Should only be sown on fertile land.

For Growth of Grain to be Thrashed.

Black Tartarian Sutton's Newmarket Garton's Abundance	Straw course in growth, but makes good fodder for stock.

Barley.

Price 12/- per 100 lbs., f.o.r. Potchefstroom.

Variety.

2 Rowed (Malting).
6 ,, (Transvaal).

Rye.

Early variety, about three weeks earlier than barley. Price 12/- per 100 lbs., f.o.r. Potchefstroom.

These varieties of grain are the best of different kinds which have been experimented upon at this farm. The seed is well grown and clean, has been well dressed, and is free from "smut" or "bunt."

Potatoes.

Seed fit for planting end of January and February. Price 12/6 per bag of 160 lbs., f.o.r. Potchefstroom.

Variety.	*Remarks.*
White Hebron	Very early.
Early Rose	Early.
Sutton's Flourball	Medium early.

Applications for these stock and seeds should be sent to the General Manager, Experimental Farm, Potchefstroom, and orders must be accompanied by Cheque or Postal Order.

The above prices are subject to alteration without notice.

ALEX. HOLM,
General Manager.

* * *

STALLION FOR PUBLIC STUD.

	Nos. of Sire.
The Clydesdale Stallion "Transagric,"	
Sire, Royal Chief	10,876
1st Dam, Minnie, Vol. XXVIII., by Barons Pride	9,122
2nd Dam, Brenda, 2nd 12,871, by MacGregor	1,487
etc., etc.	

will stand at stud at the Experimental Farm, Potchefstroom, at the service fee of £2 2s.

"Transagric" is a black horse, of fully 16 hands, on strong and short limbs, with good feet and pasterns; is full of muscle and quality, and exceedingly well coupled He is recommended for van or draught purposes.

Arrangements can be made with the General Manager, Experimental Farm, Potchefstroom, for mares to remain at this farm during the service season at reasonable charges for keep and attendance.

ALEX. HOLM,
General Manager.

* * *

SOME RECENT ADDITIONS TO THE LIBRARY OF THE DEPARTMENT.

South Africa.

Trade of the Colonies and Territories forming the South African Customs Union, for Nine Months ending September 30, 1906, and for the Month of October, 1906.

South African Stud Book, Vol. I., 1906.

Cape Colony.

The Agricultural Journal.

Reports of the Acting Chief Conservator of Forests and Conservators of Forests, Cape Colony, for the year ended September 30, 1905.

The Government Gazette.

Natal.

Report of the Government Bacteriologist, 1904-5.

The Agricultural Journal.

Orange River Colony.

Department of Agriculture.

Leaflet No. 3. Address delivered by the Director of Agriculture before the Legislative Council, July, 1906.

Bulletin No. XII. Poultry Parasites. C. Mc. G. Johnston.

Transvaal.

Minutes of a Meeting of the Transvaal Agricultural Union, held at Pretoria, 10th-13th July, 1906.

The Legislative Council. Votes and Proceedings, VI. Session, 1906.

Do. do. Reports of Select Committee, VI. Session, 1906.

1st, 2nd, 3rd, 4th and 5th Reports of the Commission appointed to report on the Public Service.

Report of Special Committee appointed to enquire into the Present Conditions in regard to the Control of Chinese Indentured Labourers in the Witwatersrand District.

Results of the Census of the Transvaal Colony and Swaziland (Final Report).

The Agricultural Journal.

Rhodesia.

The Agricultural Journal.

Great Britain.

Report of the British Association for the Advancement of Science (South Africa). 1905.

Board of Agriculture and Fisheries.

The Journal of the Board.
Leaflet 167. Ducks and Duck Breeding.
Leaflet 168. Hints on the Formation of Permanent Pastures.

Midland Agricultural and Dairy College.

Reports on Experiments with Crops and Stock in the Year 1905-6.

University of Leeds and the Yorkshire Council for Agricultural Education.

No. 60. Milk Investigations at the Manor Farm, Garforth, 1905.
No. 61. Report on a Test of 13 Varieties of Wheat at Garforth, 1906.
No. 62. Variation in the Composition of Butter Fat.
Transactions of the Highland and Agricultural Society of Scotland. Vol. XVIII., 1906.

INDIA.

The Agricultural Journal of India
The Agricultural Ledger.
The Agricultural Gazette, published under the orders of the Director of Agriculture. Central Provinces, Nagpur.

Department of Agriculture, Madras.

Bulletin No. 56. The varieties of Cultivated Pepper. C. A. Barber.
Report on the Seasons and Crops of the North-West Frontier Provinces for the year 1905-6.
Land Records. Administration Report for the year ended June 30, 1906.

Bengal Agricultural Department.

Record of Agricultural Experiments, Season 1904-5.
Annual Report of the Dumraon Experimental Farm for 1904-5.
Season and Crop Report of Bengal for the year 1905-6.
Report of the Operations of the Department of Land Records and Agriculture, Punjaub, for the year ended Sept. 30, 1905.

CANADA.

Ontario Department of Agriculture.

Bulletin 147. Fruits recommended for planting in Ontario.
27th Annual Report of the Ontario Agricultural and Experimental Union, 1905.
Report of the Farmers' Institutes of the Province of Ontario, 1905.
Ontario Agricultural College Bulletin 149. The Swine Industry in Ontario.
Bulletin 151. Farm Poultry. W. R. Graham.

Province of Saskatchewan Department of Agriculture, Statistics Branch.

Bulletin No. 4. Condition of the Crops at Harvest Time. Sept. 20, 1906.

Province of Alberta.- Department of Agriculture. Statistics Branch.

Crop Bulletin No. 3.
Estimated yield of the Principal Grain Crops. August 20, 1906.
Supplement to Crop Bulletin No. 3. September 21, 1906.

Department of Agriculture. Central Experimental Farm, Ottawa.

Bulletin No. 54. The Breeding, Feeding and General Management of Poultry.
Part I. A. G. Gilbert.
Part II. V. Fortier.

AUSTRALASIA.

Victoria.—The Agricultural Journal.
New South Wales.—The Agricultural Gazette.
Queensland.—The Agricultural Journal.
Western Australia.—The Agricultural Journal.
South Australia.—The Agricultural Journal.

NEW ZEALAND.

Department of Agriculture.—Dairying Division.

Report for 1904-5.
Bulletin 7. (A) The Acidimeter and its use. (B) The Preparation of Starters.
Bulletin 8. Review of the Work of the 1905-6 Season.

Leaflets for Farmers.

No. 76. The Manuring of Potatoes.

Chemistry Division.

Bulletin 1. Phosphates in New Zealand.

Viticultural Division.

Viticulture in New Zealand, with special reference to American Vines.—R. Bragato.
Agriculture in other Lands, with special reference to Dairying.—J. A. Kinsella.

WEST INDIES.

Board of Agriculture, Jamaica.

Report on the Experimental Work of the Sugar Experiment Station for the year 1905.
Bulletin of the Department of Agriculture, Jamaica.
Journal of the Jamaica Agricultural Society.

BRITISH EAST AFRICA.

Department of Agriculture, Nairobi.

Leaflet No. 18. Tobacco.

UNITED STATES OF AMERICA.

United States Department of Agriculture. - Office of Experiment Stations.

Experiment Station Record, Vol. XVII, Nos. 10, 11 and 12 (June, July and August, 1906). Vol. XVIII., No. 1 (September, 1906).

Agricultural Colleges and Experiment Stations.

Arizona.—Bulletin 53. Irrigating Sediments and their effects upon Crops.

California.—Bulletin 177. A New Method of Making Dry Red Wine.

Hawaii.—Press Bulletin No. 16. The Avocado Mealy-Bug.
Press Bulletin No. 17. The Mango Weevil.

Kansas.—Bulletin No. 136. Comprising Press Bulletins Nos. 125-151.
Bulletin 137. Variations in the Test of Separator Cream.
Bulletin No. 138. Effect of Bacteria in Wash Water of Butter.
Bulletin No. 139. The Study of Corn.

Michigan.—Bulletin No. 236. Spraying for Potato Blight in 1905.
Bulletin No. 237. Digester Tankage for Swine.

North Dakota.—Bulletin No. 70. Paints and their Compositions.

South Dakota.—Bulletin No. 97. Speltz and Millet for the Production of Baby Beef.

Texas.—Bulletin No. 84. Tomato Fertilizers at Troupe.

Virginia.—Bulletin No. 160. The Influence of Selected Yeasts upon Fermentation.
Bulletin No. 161. Varieties of Fruit for the Home Orchard.
Bulletin No. 162. Improving the Quality of Cream from Inferior Milk.

Wyoming.—Bulletin No. 70.—Wyoming Forage Plants and their Chemical Composition.

Experiment Station of the Hawaiian Sugar Planters' Association.—Division of Agriculture and Chemistry.

Bulletin No. 17. Comparative Tests with varieties of Sugar Cane.
Bulletin No. 18. Hawaiian Waste Molasses.

S. W. WAGSTAFF,
Librarian.

GENERAL NOTICES.

LIST OF FARMERS' ASSOCIATIONS AND AGRICULTURAL SOCIETIES IN THE TRANSVAAL.

Aapjes River Ward Agricultural Society, A. F. von Gass, Pyramid Station.
Barberton Farmers' Association, Geo. E. O. Wilhelm, Box 157, Barberton.
Barberton Agricultural Society, J. S. Dyce, Barberton.
Bloemhof Agricultural Society, W. L. Dagg, Bloemhof.
Carolina Agricultural Society, M. van Enter, Box 43, Carolina.
Christiana Agricultural Society, Secretary, Christiana.
Crocodile River Farmers' Association, F. J. van Deventer, Box 751, Pretoria
Eastern Transvaal Farmers' Association, T. W. Snaith, Box 75, Springs.
Ermelo Agricultural Society, A. Smuts, Box 5, Ermelo.
Elandsriver Farmers' Association, E. H. Eloff, Rietvlei, Lindley's Poort, Rustenburg.
Haenertsburg Farmers' Association, Haenertsburg, *via* Pietersburg.
Heidelberg Agricultural Society, W. Harvey, Box 36, Heidelberg.
Hekpoort Farmers' Association, Secretary, *via* Krugersdorp.
Hex River Farmers' Association, W. Breedt, Hex River, Rustenburg.
Highveld Farmers' Association, F. Findley, Ceylon, *via* Krugersdorp.
Klerksdorp Agricultural Society, H. Bramley, Box 56, Klerksdorp.
Klipriver Farmers' Association, Krugersdorp.
Koesterfontein Farmers' Association, Secretary, *via* Krugersdorp.
Krugersdorp Farmers' Association, G. Figulus, Box 188, Krugersdorp.
Krugersdorp Agricultural Society, H. A. von Blommestein, Box 368, Krugersdorp.
Lydenburg Agricultural Society, S. Hiemstra, Box 69, Lydenburg.
Lydenburg Farmers' Association, E. de Souza, Lydenburg.
Leuwdoorns Farmers' Association, W. Sterling Hamilton, Syfergat, Leuwdoorns, *via* Klerksdorp.
Marico Agricultural Society, J. L. van Heerden, Box 82, Zeerust.
Middelburg Agricultural Society, F. Schunke, Box 75, Middelburg.
New Scotland Farmers' Association, H. S. Parry, Grasdal, Lake Chrissie.
New Agatha Farmers' Association, R. F. Shirley, New Agatha, *via* Pietersburg.
Pietersburg Agricultural Society, J. W. Johnson, Box 32, Pietersburg.
Pietersburg Farmers' Association, G. G. Munnik, Pietersburg.
Pietersburg Poultry Club, H. Moore, Box 103, Pietersburg.
Piet Retief Farmers' Association, K. P. van Dijk, Box 18, Piet Retief.
Platrand Farmers' Association, A. H. Barron, Platrand.
Potchefstroom Agricultural Society, Secretary, Box 70, Potchefstroom.
Pretoria Agricultural Society, H. Cornforth, Box 685, Pretoria.
Rand Poultry Club, F. H. Stoll, Box 2712, Johannesburg.
Rustenburg Farmers' Association, Leo Machol, Rustenburg.
"Settlers' Association," Hon. H Wyndham, Kroomdraai.
Southern Waterberg Farmers' Association, C. M. Quarry, P.O., Warmbaths.
Standerton Agricultural Society, F. C. de Witt, Box 158, Standerton.
Spelonken Farmers' Association, W. J. Brickhill, P.O., Spelonken, Zoutpansberg.
Transvaal Agricultural Union, F. T. Nicholson, Box 134, Pretoria.
Transvaal Poultry Club, J. F. Hilson, Box 1129, Pretoria.
Transvaal Stockbreeders' Association, F. T. Nicholson, Box 134, Pretoria.
Vaal River Farmers' Association, J. van Zijl, *via* Potchefstroom.
Waterberg Agricultural Society, I. von Backstroom, Box 7, Nylstroom.
Wakkerstroom Agricultural Society, G. Maasdorp, Volksrust.
Witfontein Farmers' Association, J. Krugel, *via* Krugersdorp.
Witwatersrand Farmers' Association, H. J. A. Wentworth, P.O. Craighall, near Johannesburg.
Witwatersrand Dairy Farmers' Association, H. Clarke, Box 5908, Johannesburg.
Witwatersrand Agricultural Society, W. H. Poultney, Box 4344, Johannesburg.
White River Farmers' Association, Archibald T. Ralls, White River, *via* Nelspruit.
Wolmaransstad Farmers' Association, F. W. Konig, Box 1, Wolmaransstad.
Wonderfontein Farmers' Association, Secretary, *via* Krugersdorp.
Woodbush Farmers' Association, Secretary and Treasurer, Percy Kent, Spitskop, P.O. Haenertsburg.

Zwartkop Farmers' Association, M. Vorster, Zwartkop, *via* Krugersdorp.
Zwartruggens Farmers' and Planters' Association, G. R. Wedderburn, J.P., Broadwood Vale, P.O. Kosterfontein, Rustenburg.
Transvaal Land Owners' Association, H. A. Baily, Box 1281, Johannesburg.

OTHER COLONIES.

Agricultural Union of Cape Colony, D. M. Brown, Box 187, Port Elizabeth.
Cape Central Farmers' Association, H. C. Hall, Bedford, Cape Colony.
Cape Stud Breeders' Association, J. Pike, Box 703, Capetown.
Natal Agricultural Union, D. M. Eadie, Timber Street, Pietermaritzburg.
Orange River Colony Farmers' Association, Stuart L. Mackenzie, Secretary, Bloemfontein.
Orange River Colony Co-operative Union, J. Brink, Secretary, Heilbron, O.R.C.
Orange River Colony Stockbreeders' Association, Secretary, Bloemfontein.
Rhodesian Agricultural Union, Secretary, Box 135, Salisbury, Rhodesia.

* * *

PORTS FOR ENTRY OF STOCK.

The following are the ports for entry of stock into this Colony from the neighbouring Territories :—

Mafeking Road Border	Cape Colony.
Mosimyani	,,
Fourteen Streams	,,
Coal Mine Drift	Orange River Colony.
Vereeniging	,,
Roberts' Drift	,,
Volksrust	Natal.

Komatiepoort, through which stock not provided for under Clause 5, Government Notice No. 834 of 1903, will only be allowed to proceed by rail, to be examined at Machadodorp, Portuguese East Africa.

* * *

DISEASES OF STOCK.

(Government Notice No. 834 of 1903.)

1. In these Regulations the term "stock" means cattle, sheep, goats, horses, mules, donkeys, and pigs.

2. The following diseases shall be considered contagious diseases for the purpose of these Regulations, and shall be dealt with as hereinafter directed. The list may be added to by Proclamation in the "Gazette" :—

(*a*) Rinderpest.
(*b*) Pleuro-pneumonia (or lung-sickness).
(*c*) Redwater and Rhodesian Redwater.
(*d*) Tuberculosis.
(*e*) Foot and Mouth Disease.
(*f*) Anthrax (or splenic fever).
(*g*) Glanders and Farcy.
(*h*) Scab in Sheep and Goats.
(*i*) Swine Fever.
(*j*) Swine Erysipelas.
(*k*) Mange (Scabies) in Horses and Mules.
(*l*) Ulcerative Lymphangitis.
(*m*) Sheep Pox.

* * *

AFRICAN COAST FEVER.

Amended Proclamation of the Cape Colony.

By Proclamation No. 231, of July 22nd, 1904, the provisions of Proclamation No. 202, of June 29th, 1904, are amended as follows :—

Dogs and Cats will be admitted with special permission of the Chief Veterinary Surgeon, or his authorised representative, provided they are accompanied by a certificate signed by the Principal Veterinary Surgeon of the Transvaal, or his authorised representative, to the effect that they have not come from or passed through any portion of the Transvaal proclaimed or known to be infected with African Coast Fever.

MADAGASCAR CATTLE.

His Majesty's Consul at Antananarivo has notified His Excellency the High Commissioner that the Export Duty on bullocks from Madagascar has been reduced from twelve shillings to two shillings per head.

* * *

AN ORDINANCE (No. 3 OF 1906) TO IMPOSE A DUTY ON THE EXPORT OF ANGORA RAMS AND EWES.

Be it enacted by the Lieutenant-Governor of The Transvaal with the advice and consent of the Legislative Council thereof as follows:—

1. Upon every Angora ram or ewe exported from this Colony after the date of the taking effect of this Ordinance there shall be payable save as herein provided to the officer appointed to receive the same a duty of one hundred pounds; provided always that no such duty shall be payable on the export of any such ram or ewe to any Colony or Territory in South Africa as soon as the Lieutenant-Governor shall by proclamation declare that such Colony or Territory has by statute provided for the imposition of a duty on the export of Angora rams and ewes not less than the amount imposed by this Ordinance.

2. Every person who shall export from this Colony any Angora ram or ewe (save as in this Ordinance provided) without payment of the duty imposed thereby shall be liable on conviction in addition to the duty to a fine of not less than twenty-five pounds and not exceeding one hundred pounds for every such ram or ewe so exported and in default of payment to imprisonment with or without hard labour for a period of not less than one month and not exceeding six months unless such fine be sooner paid.

3. Courts of Resident Magistrate shall have special jurisdiction to impose any of the penalties provided by this Ordinance for a contravention hereof.

4. It shall be lawful for the Lieutenant-Governor from time to time to make Regulations for carrying out the provisions of this Ordinance.

5. This Ordinance may be cited for all purposes as the Angora Export Duty Ordinance 1906.

Passed in Council the twenty-eighth day of June, One Thousand Nine Hundred and Six.

* * *

DESTRUCTION OF VERMIN.

The following regulation (Section D of Government Notice No. 1341 of 1906) is published for general information:—

(D.)—VERMIN.

16. The animals named in Schedule F hereto shall be deemed to be vermin, and rewards for the destruction of them shall be paid at the rates shewn in the Schedule by the Resident Magistrate of the district in which they are destroyed.

17. Vermin may be destroyed by shooting, coursing, by means of nets, springes, gins, traps, snares or by poison, provided that when poison is used for the destruction its use shall be subject to such conditions as the Resident Magistrate of the district may prescribe, and provided that no poison may be used during the open season.

18. In proof of the destruction of vermin the applicant for reward will be required to produce in the case of lion, leopard, cheetah, lynx, serval cat, civet cat, Kaffir cat, genet cat, silver jackal and red jackal, the skin with the tail not severed; and in the case of wild dog, hyena and baboon the head; and will also be required to make a written declaration in the form given in Schedule G hereto.

19. The skins of vermin for the destruction of which reward has been paid shall be the property of the Government, and shall, if in good condition, be marked by the official before whom they are produced at the juncture of the tail with the skin of the body with a perforating stamp, or in such other way as the Colonial Secretary may from time to time prescribe, and thereafter be sold by the Resident Magistrate by public auction or disposed of in such other way as he may consider to be best in the interests of the Government. The proceeds of such sale or disposal shall be paid into Revenue.

Skins not in good condition and heads shall be destroyed.

20. Any person who secures or attempts to secure for himself or any other person a reward for the destruction of vermin by means of a false declaration or by the production of skins or heads belonging to vermin, for the destruction of which a reward has already been

paid, shall be liable on conviction to a fine not exceeding £10 for every head of vermin for which he has secured or attempted to secure such reward.

SCHEDULE F.

	£	s.	d.
Wild Dog	1	0	0
Silver Jackal	0	2	6
Red Jackal	0	5	0
Baboon	0	2	6

SCHEDULE G.

I, ...
hereby declare that the following animals :—
....
....
....
....
have been destroyed by me within the official boundaries of the.......................................
District, and that the skins and tails (or heads) I have produced to the Resident Magistrate actually belonged to such animals.

* * *

REGULATIONS AND CONDITIONS FOR THE HIRE OF A GOVERNMENT WATER DRILL FOR BORING FOR WATER.

1.—SUBMISSION OF APPLICATIONS.

Applications by farmers for the hire of a Government Water Drill for boring for water should be sent on form $\frac{\text{I. D.}}{\text{B.}}$ No. 49 (Revised), to the Boring Engineer, Irrigation Department, P.O. Box 557, Pretoria, through the Resident Magistrate of the district in which the applicant resides.

* * *

GOVERNMENT NOTICE No. 522 OF 1906.

Under and by virtue of the powers in him vested by Section 4 of the Diseases of Stock Ordinance of 1902, His Excellency the Acting Lieutenant-Governor has been pleased to prohibit, until further notice, the importation of cattle from the Colony of Natal, with the exception of

(1) Stock entering under permit from oversea and passing through Natal by rail ;
(2) Slaughter stock travelling direct by rail under permit to any enclosure approved by the Government Veterinary Department for the reception of such slaughter stock.

By Command of His Excellency the Acting Lieutenant-Governor.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 25th May, 1906.

* * *

GOVERNMENT NOTICE No. 523 OF 1906.

His Excellency the Acting Lieutenant-Governor has been pleased to make the following regulation under Section 5 of the Diseases of Stock Ordinance of 1902.

Any person who shall import or cause to be imported any stock into this Colony in contravention of the terms of Government Notice No. 522 of 1906, or who shall remove any stock alive from any enclosure therein mentioned, shall be liable upon conviction to a penalty not exceeding Fifty Pounds, and in default of payment of the same to imprisonment with or without hard labour for a period not exceeding six months.

Any cattle introduced without such permit as is mentioned in the said Government Notice may be slaughtered by order of the Commissioner of Lands, or dealt with in whatever manner the Commissioner may prescribe.

By Command of His Excellency the Acting Lieutenant-Governor.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 25th May, 1906.

RABIES IN RHODESIA.

The Secretary for Agriculture writes as follows:—

The disease is increasing. The last outbreak in a previously non-infected area occurred at a farm in the Enterprise District, about 25 miles from Salisbury, on 25th ultimo. Within the past six months one European and two natives have died of hydrophobia. The nearest reported case to the Transvaal border during the past twelve months occurred near the township of Gwanda.

Steps are now being taken to have all dogs in the country registered, and it is hoped by this means to reduce the number of native owned dogs, which are regarded as the chief cause of the spread of the disease, and to trace the source of any outbreak, so that the number of dogs in the district of origin may if necessary be destroyed.

* * *

TRANSVAAL INDIGENCY COMMISSION.

1. To enquire and report whether conditions of indigency exist among persons of European nationality in the Transvaal such as to require remedial measures.
2. To consider the origin and effect of such conditions:—
   (a) as affecting persons born in South Africa;
   (b) as affecting persons who have immigrated from other countries.
3. To enquire and report as to the cause of such conditions and, in particular, how far they arise from any or all of the following causes:—
   (a) general economic conditions, whether temporary or permanent;
   (b) the operation of particular laws or customs, especially those relating to the tenure and transmission of landed property;
   (c) deficiencies in training or education.
4. To enquire and report what measures should be taken, if any, for the abatement of the evil, and more particularly to advise how far those measures should be taken by the Government, how far by Local Authorities and how far by private agencies; and to what extent, in the last two cases, Local Authorities or private agencies should be subsidised and controlled by the Government.
5. To enquire into the control of public orphanages, and to advise whether they should be managed and paid for by the Government, and, if not, whether they should be managed and paid for by Local Authorities or private Societies, and, if so, how far it is desirable that such Local Authorities or private Societies should be subsidised by the Government.

The members are:

John William Quinn (*Chairman*), General Louis Botha, Hugh Crawford, Richard Feetham, Johan Rissik, Frank Braybrooke Smith (*Director of Agriculture*).

Mr. Philip Henry Kerr, Assistant Secretary to the Inter-Colonial Council, has been appointed Secretary to the Commission.

* * *

The following is published for general information

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 29th October, 1906.

It is hereby notified for general information that the undermentioned brands have been duly allotted and registered under the Great Stock Brands Ordinance (Ordinance No. 15 of 1904) during the quarter ending the 30th September, 1906.

F. B. SMITH,
Director of Agriculture.

Pretoria, 29th October, 1906.

Brand, No. of	Name of Owner.	Address.	District.	Brand.
254	Bowden, Frederick Mifflin	P.O. Box 115, Middelburg	Middelburg	GB7
255	Joffe, Bar	P.O. Box 20, Krugersdorp	Krugersdorp	KJ2
256	Buskes, Fredericus Hubertus Johannes	Tarbet No. 7, P.O. Lake Chrissie	Ermelo	EBO
257	Goudkoppies Pound	Goudkoppies, Railway Station, Nancefield	Krugersdorp	◊ K5
258	Lukey, Harold	Uplands 54, P.O. Ventersdorp	Potchefstroom	P3L
259	Kirkman, William Rufus	Vaalwater No. 5, P.O. Zandriviersspoort	Waterberg	WK7

No. of Brand.	Name of Owner.	Address.	District.	Brand
260	Herbst, Willem Jacobus	Vastfontein 128, P.O. Pyramids	Pretoria	A8H
261	White, Harry Bartlett	Geduld, P.O. Box 41, Springs	,,	AW1
262	Hay, James	Nelspan 34, P.O. Kaffirspruit	Ermelo	E2H
263	Pienaar, Jacobus Stephanus Johannes	Leliespan, P.O. Doornbult	Lichtenburg	L7J
264	Linley, Florence May	P.O. Box 1, Lichtenburg	,,	L7L
265	Staines, Charles Henry	Rykarts Post, P.O. Palmietfontein	Potchefstroom	P1S
266	Honden Rivier Pound	S.A.C., Bronkhorstspruit	Pretoria	◊A7
267	Janson, Simon	P.O. Dullstroom	Lydenburg	YJ1
268	Middelton, Alexander	Nelspan, P.O. Davel	Ermelo	E7M
269	Oosthuyse, Maria Gertruida Wilhelmina	Goede Hoop 26, P.O. Box 86, Ermelo	,,	EOM
270	Brits, Gert Pieter	Stilfontein, P.O. Koekemoer	Potchefstroom	PB4
271	Drieselmann, Wilhelm Peter Franz	P.O. Box 72, Heidelberg	Heidelberg	HD7
272	Vereeniging Estates, Limited	P.O. Vereeniging	,,	HV1
273	McLaren, William Alexander	P.O. Box 1209, Johannesburg	,,	HF1
274	Murray, George Hedley	P.O. Box 9, Balfour	,,	HOM
275	Klassnik, Mayer	P.O. Heidelberg	,,	HK7
276	Pagan, John	P.O. Box 74, Heidelberg	,,	HP7
277	Government Veterinary Bacteriological Division	Agricultural Department, Daspoort	Pretoria	DOB
278	Vereeniging Municipality	P.O. Vereeniging	Heidelberg	HV2
279	Roseinbloom, Charles Samuel	Hammanskraal, P.O. Hammanskraal	Pretoria	A3R
280	Coleman, Ernest Charles	Zanddrift, P.O. Klipkop	Rustenburg	RE3
281	Bands, Thomas	,, ,,	,,	RT7
282	Lombaard, Michiel Arnoldus	Wintershoek, P.O. Wonderfontein	Middelburg	GA7
283	Ford Bros. (Ford, Albert John, and Ford, George Henry Hope)	118 Fox Street, P.O. Box 1797, Johannesburg	Witwatersrand	XFO
284	Odendaal & Perks (Odendaal, Wessels Nicholas, and Perks, John Clarke)	P.O. Box 199, Boksburg	,,	XOP
285	Sutter & Co., George	Warmbaths	Waterberg	WS5
286	Struben, Robert Henry	The Pyramids 370, P.O. Box 1128, Pretoria	Pretoria	A7S
287	Zyl, van, Gideon Johannes	Misgund, P.O. Eikenhoff	Krugersdorp	KZ1
288	Tuback, Isaac	Ottoshoop, P.O. Ottoshoop	Marico	M1T
289	Rabie, Carel Theodorus	P.O. Box 65, Lydenburg	Lydenburg	YR1
290	Commercial General Agency Co., Limited	P.O. Box 784, Pretoria	Pretoria	AA1
291	Hammann, Johannes Nicolaas	Lichtenburg	Lichtenburg	L7H
292	Nysschen, de, Andries Martinus	Tweebuffelsgeschiet 34, P.O. Linleyville	,,	LD7
293	Moodie, Charles Edward	Driefontein, 823, P.O. Zandriviersppoort	Waterberg	W8M
294	Strauss, Jacobus Johannes	Verlatenkraal 156, P.O. Kingswood	Bloemhof	BJ1
295	Wyk, van, Willem	Verlatenkraal 156, P.O. Kingswood	,,	BV3
296	Scholtz, Daniel Johannes Jacobus	Matlabansstad, P.O. Bloemhof	,,	BD1
297	Niekerk, van, Hendrik François	Rietfontein ,,	,,	BH2
298	Scholtz, Louwrens Marthinus	Matlabansstad ,,	,,	BL1
299	Niekerk, van, Pieter Johannes	Rietfontein ,,	,,	BP2
300	Jordaan, Alwyn Pieter	Kaalpan ,,	,,	BP1
301	Strauss, Willem Petrus	Palmietfontein ,,	,,	B1S
302	Oxlee, Frank James	Bloemhof	,,	B1X
303	Kuit, Albert	P.O. Amersfoort	Wakkerstroom	UKO
304	Lotz, Johannes Jurgens	Hartebeestefontein, P.O. Amersfoort	,,	UJ2

Brand, No. of	Name of Owner.	Address.	District.	Brand
305	Neser, Johannes Adrian	P.O. Amersfoort	,,	UN1
306	Scheffer, Martin Fredrik	,,	,,	US8
307	Maynard, Percy McAdam	The Pyramids 370, P.O. Box 1128, Pretoria	Pretoria	A4M
308	New Transvaal Chemical Co., Limited	Halfway, P.O. Box 85, Knights	Witwatersrand	XSO
309	Schulenburg, Heinrich Wilhelm	P.O. Rooijantsfontein	Lichtenburg	L7S
310	Martinus (Native)	Rooikoppies 287, P.O. Standerton	Standerton	SMO
311	Magnet Heights Pound	Magnet Heights, P.O Schoonoord	Lydenburg	◊ Y3
312	Schoemanskloof Pound	Schoemanskloof, P.O. Schoemanskloof	,,	◊ Y4
313	Bekker, Marthinus Johannes	Leeuwfontein 143, P.O Wolmaransstad	Wolmaransstad	VB1
314	Peypers, Johannes Hermanus	Bavianskrans, P.O. Leeuwdoorns	,,	V9P
315	King, George	Rietfontein 159, P.O. Kingswood	.	V1K
316	King, Alexander	Rietfontein 159, P.O. Kingswood	,,	VK1
317	Kritzinger, Stephanus Jacobus	Doorndam 36, P.O. Maquassi	.	V1S
318	Bezuidenhout, Johannes Stephanus	Doornfontein 66 P.O Maquassi	,	VB2
319	Sauer, Simon Lodewyk	Klipkuil 99, P.O. Leeuwdoorns	,,	VSO
320	Herwaarde, van, Nicolaas Antonie	Diepkuil 11. ,,	,,	V1N
321	Bets, Pieter Frederik	Klipkop 82. ,,	,,	VP1
322	Sterling-Hamilton, William	Syfergat. ,,	,,	VH2
323	Battine, Cecil William	Zwartlaagte 76, P.O. Harrisburg	,,	V1C
324	Coetzee, Jacobus Francois	Klipkuil 46, P.O. Maquassi	,,	V1J
325	Botha, Johannes Georg	Brandewynskuil 37, P.O. Maquassi	.	VJ2
326	Walt, van der, Johannes Nicolaas	Leeuwboschen, P.O. Kingswood	,,	V2J
327	Erasmus, Willem Jacobus	P.O. Zendelingsfontein	,,	V1E
328	Brink, Wouter Cornelis Justinus	Vlakfontein, P.O. Zendelingsfontein	,,	V1B
329	Rayton Township Pound	Rayton Township	Pretoria	◊ A9
330	Henderson, Frank	Grasdale, P.O. Lake Chrissie	Ermelo	E1H
331	Westgate, Stanley Charles	Holmdene, P.O. Holmdene	Standerton	SW6

TRANSVAAL METEOROLOGICAL DEPARTMENT.

RAINFALL RETURNS FOR THE MONTHS OF SEPTEMBER, OCTOBER, AND NOVEMBER, 1906.

NOTE. The rainy season is measured from 1st July in one year to the 30th June in the next..

SEPTEMBER, 1906.

District.	Place.	September. In.	September. Days.
Barberton	Barberton	1·67	3
	Komati Poort	3·10	4
Bethal	Bethal	0·83	3
Bloemhof	Bloemhof..	0·56	2
	Christiana	0·18	1
Carolina	Machadodorp	2·08	3
Ermelo	Ermelo	1·08	5
Heidelberg	Heidelberg	0·47	3
	Vereeniging	0·50	2
Lichtenburg	Lichtenburg	0·07	2
Lydenburg	Belfast	2·14	6
	Pilgrims Rest	1·28	6
Marico	Zeerust	0·02	1
Middelburg	Middelburg..	1·43	4
	Pan	1·72	4
Piet Retief	Piet Retief	2·71	5
Potchefstroom	Potchefstroom	0·13	3
	Klerksdorp	0·12	2
Pretoria	Arcadia, Pretoria	0·34	2
	Modderfontein	0·34	2
Rustenburg	Rustenburg	0·13	2
Standerton	Standerton	2·04	3
Swaziland	Mbabane	4·06	6
Wakkerstroom	Wakkerstroom	1·43	8
	Volksrust	1·40	6
Waterberg	Nylstroom	2·81	1
	Potgietersrust	2·08	1
Witwatersrand	Krugersdorp	0·34	2
	Joubert Park, Johannesburg ..	0·63	2
	Zuurbekom	0·15	2
	Government Observatory ..	0·51	2
Wolmaransstad	Wolmaransstad	Nil.	0
Zoutpansberg	Pietersburg	1·67	2
	Louis Trichardt	2·42	4
	Leydsdorp	2·80	2

OCTOBER, 1906.

District.	Place.	October. In.	October. Days.
Barberton	Barberton	5·21	15
Bethal	Bethal	4·86	12
Bloemhof	Bloemhof	2·19	6
Carolina	Machadodorp	2·80	14
Ermelo	Ermelo	5·39	12
Heidelberg	Heidelberg	2·60	10
	Vereeniging	2·88	12
Lichtenburg	Lichtenburg	1·71	9
Lydenburg	Belfast	3·69	14
Marico	Zeerust	3·71	11
Middelburg	Middelburg	4·66	15
	Pan	4·54	10
Piet Retief	Piet Retief	6·07	16
Potchefstroom	Potchefstroom	2·21	8
Pretoria	Arcadia, Pretoria	3·28	8
	Modderfontein	3·22	10
Rustenburg	Rustenburg	2·86	9
Standerton	Hamelfontein	4·81	10
Swaziland	Mbabane	6·05	17
Wakkerstroom	Rolfontein	6·25	9
Waterberg	Nylstroom	3·29	7
	Potgietersrust	2·34	12
Witwatersrand	Krugersdorp	3·05	11
	Zuurbekom	2·70	11
	Government Observatory	4·69	10
Wolmaransstad	Wolmaransstad	2·68	9
Zoutpansberg	Leydsdorp	4·91	13

NOVEMBER, 1906.

District.	Place.	November. In.	November. Days.
Barberton	Barberton	4·82	12
	Komati Poort	2·44	10
Bethal	Bethal	3·99	14
Bloemhof	Bloemhof	1·70	15
Carolina	Machadodorp	3·52	18
Ermelo	Ermelo	5·59	15
Heidelberg	Heidelberg	3·93	8
	Vereeniging	3·19	11
Lichtenburg	Lichtenburg	2·84	10
Lydenburg	Belfast	2·46	14
	Pilgrims Rest	5·37	17
Marico	Zeerust	7·38	11
Middelburg	Middelburg	6·22	17
	Pan	3·85	15
Piet Retief	Piet Retief	6·56	20
Potchefstroom	Potchefstroom	3·99	11
	Klerksdorp	3·52	10
Pretoria	Arcadia, Pretoria	5·25	16
	Modderfontein	5·14	10
Rustenburg	Wolhuter's Kop	6·51	11
Standerton	Standerton	4·81	8
Swaziland	Mbabane	5·18	16
Wakkerstroom	Wakkerstroom	5·45	13
	Volksrust	7·12	14
Waterberg	Nylstroom	2·34	8
	Potgietersrust	4·32	11
Witwatersrand	Krugersdorp	4·50	13
	Joubert Park, Johannesburg ...	6·08	13
	Zuurbekom	3·49	14
	Government Observatory	5·34	12
Wolmaransstad	Wolmaransstad	0·72	10
Zoutpansberg	Leydsdorp	7·94	12
	Louis Trichardt	7·62	17
	Pietersburg	2·19	11

PRETORIA AND JOHANNESBURG PRODUCE MARKET PRICES.

(Supplied by the Commercial Agency Co., Limited, Seed and Produce Merchants No. 116, Vermeulen Street; Telephone No. 165; Box 784, Pretoria; and by Messrs. Hubert Morisse & Co., Produce Merchants and Commission Agents, Loveday and Frederick Streets, Box 68, Johannesburg.)

PRETORIA.

Description.	*September*, 1906.		*October*, 1906.		*November*, 1906.	
	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Forage, per 100 bundles ...	0 12 6	1 5 0	0 15 0	1 6 6	0 7 0	1 1 0
Mealies	0 12 6	0 14 0	0 14 3	0 15 6	0 14 0	0 16 9
Kaffir Corn	0 13 0	0 15 3	0 15 0	0 15 6	0 15 3	0 19 6
Wheat	—	1 7 6	—	1 7 6	—	1 6 0
Oats	0 16 0	0 18 0	0 14 6	0 16 6	0 12 6	0 14 6
Barley		—	—	—	—	—
Bran ...	0 9 6	0 10 0	0 9 9	0 10 6	0 8 0	0 10 0
Chaff, per bale	0 3 0	0 9 3	0 5 9	0 8 3	0 4 0	0 8 3
Grass, per bale	0 0 3	0 1 6	0 0 9	0 1 5	0 1 4	0 2 1
Green Lucerne, per doz ...	0 0 9	0 1 3	0 1 0	0 1 6	0 0 9	0 1 6
Green Barley	0 0 9	0 2 9	0 0 9	0 1 6	0 0 9	0 1 3
Potatoes, per bag ...	0 13 9	1 0 6	1 0 6	1 6 6	0 6 0	1 3 6
Onions, per bag ...	0 13 6	0 16 6	0 12 6	0 14 0	0 5 0	0 15 6
Sweet Potatoes, per bag ...	0 5 0	0 8 0	-	—	—	—
Pumpkins	0 0 3	0 1 6	—	—	—	0 0 5
Oranges, per 100 ...	0 2 0	0 10 0	0 5 6	0 10 9	0 4 0	1 3 0
Naartjes, per 100 ...	0 1 6	0 10 0	0 2 0	0 8 0	—	—
Lemons, per 100	0 1 3	0 5 9	0 2 6	0 6 3	0 1 3	0 5 6
Eggs, per doz.	0 1 2	0 2 1	0 1 2	0 2 0	0 1 1	0 2 4
Fowls, each ...	0 1 7	0 4 1	0 1 8	0 2 11	0 1 9	0 4 8
Ducks, each	0 3 0	0 3 6	0 3 1	0 3 7	0 2 9	0 3 10
„ Muscovies ...	-	—	0 3 6	0 4 1	—	0 2 9
Guinea Fowls, each ...	—	0 2 9	—	-	0 2 9	0 3 1
Turkeys, each ...	0 8 3	0 14 0	0 8 6	0 15 0	0 14 0	0 18 6
Geese, each	—	-	—	—	—	—
Tobacco, per roll	0 0 3	0 0 9	0 0 6	0 1 0	0 1 0	0 1 3
„ cut, per lb. ...	—	—	0 0 3	0 0 4	0 0 2	0 0 6
„ leaf, per lb. ...	-	—	- -	—	-	—
Pigs, each	0 15 0	3 15 0	0 12 0	2 8 6	0 6 0	1 3 0
Wood, per load ...	0 12 0	2 17 6	1 7 6	3 10 0	0 10 0	3 7 6
Butter, per lb.	—	0 1 10	0 1 6	0 1 9	—	0 1 6

JOHANNESBURG.

Description.	*September*, 1906.						*October*, 1906.						*November*, 1906.					
	Lowest.			Highest.			Lowest.			Highest.			Lowest.			Highest.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Barley, per 168 lbs. ...	0	11	0	0	12	3	0	11	0	0	11	9	0	9	6	0	11	6
Bran, per 100 lbs (Colonial)	0	8	6	0	9	0	0	8	6	0	8	9	0	8	3	0	8	9
Chaff, best, per 100 lbs ..	0	4	0	0	4	6	0	4	0	0	4	6	0	4	0	0	5	0
„ medium „ .	0	1	9	0	3	6	0	1	0	0	3	6	0	3	0	0	3	9
Eggs, per doz.	0	0	11	0	1	6	0	1	1	0	1	3	0	0	6	0	1	3½
Salt, per bag	0	6	6	0	6	9	0	6	0	0	6	6	0	5	6	0	6	0
Forage (Transvaal) ...	0	7	0	0	7	9	0	7	0	0	7	9	0	5	0	0	6	9
„ (Col'nal) best per 100lbs	0	7	0	0	7	9	0	7	0	0	7	9	0	6	9	0	7	6
„ „ med „	0	5	0	0	6	9	0	5	0	0	6	9	0	5	0	0	6	6
S. Meal, good	1	3	0	1	5	6	1	3	0	1	5	0	1	3	6	1	5	0
Rye	1	1	6	1	2	0	1	1	6	1	2	0	1	2	0	1	2	6
Wheat	0	19	6	1	1	6	0	19	6	1	1	6	0	19	6	1	2	0
Mealies, Hickory KingWhites	0	13	3	0	14	6	0	14	3	0	14	6	0	13	9	0	14	9
„ (O.R.C.) whites ...	0	13	3	0	13	9	0	14	0	0	14	6	0	13	6	0	14	6
„ Yellow	0	13	3	0	14	3	0	14	0	0	14	6	0	13	9	0	14	6
Kaffir Corn, per 203 lbs ...	0	12	9	0	14	3	0	13	6	0	15	3	0	12	3	0	15	3
Hay (Transvaal) per 75 lbs.	0	0	6	0	0	9	0	1	0	0	1	6	0	1	5	0	2	3
Lucerne, per 100 lbs. ...	0	7	0	0	7	6	0	6	0	0	6	6	0	6	3	0	7	0
Potatoes, best, per 163 lbs.	0	14	6	1	0	0	0	18	0	1	1	6	0	9	6	1	12	6
„ med. „ ...	0	12	6	0	15	0	0	14	0	0	17	6	0	6	0	0	12	6
„ inferior „ ...	0	10	0	0	13	0	0	10	0	0	13	6	0	2	0	0	10	6
Onions, good, per 125 lbs	0	11	0	0	13	0	0	10	0	0	11	6	0	3	0	0	11	6
Pigs, live weight, per lb ...	0	0	3	0	0	3½	0	0	3	0	0	3¾	0	0	3½	0	0	4¾
Turkeys, cocks	0	6	0	0	10	6	0	9	0	0	16	0	0	10	6	0	16	6
„ hens ..	0	4	6	0	6	6	0	6	6	0	8	6	0	6	9	0	9	0
Fowls	0	2	0	0	3	3	0	2	6	0	3	6	0	2	3	0	3	9
Ducks	0	3	0	0	3	6	0	4	0	0	4	6	0	3	6	0	4	1
Geese	0	7	6	0	9	0	0	7	6	0	9	0	0	5	9	0	9	0
Butter (O.R.C.)	0	0	9	0	1	3	0	0	9	0	1	3	0	1	0	0	1	4
Pumpkins, per 100 lb ...	0	4	0	0	5	0	0	4	0	0	5	0	0	3	6	0	5	0
Beans, sound, per 200 lbs...	0	19	6	2	5	0	0	19	6	2	5	0	0	19	6	2	5	0
Bedding, per bale	0	0	6	0	1	0	0	1	0	0	1	6	0	1	0	0	1	6
Sweet Grass, per bale ...	0	1	3	0	3	0	0	2	4	0	3	0	0	2	0	0	2	9

Photo by Rudolf Ste e.]

General Louis Botha, M.L.A.,
Premier and Minister of Agriculture

Plate CLXXVIII

The Fowl Tick.
(*Argas persicus*)

A. Dorsal (upper) surface
B. Ventral (lower) surface

C. Eggs much enlarged.
D. Tick natural size

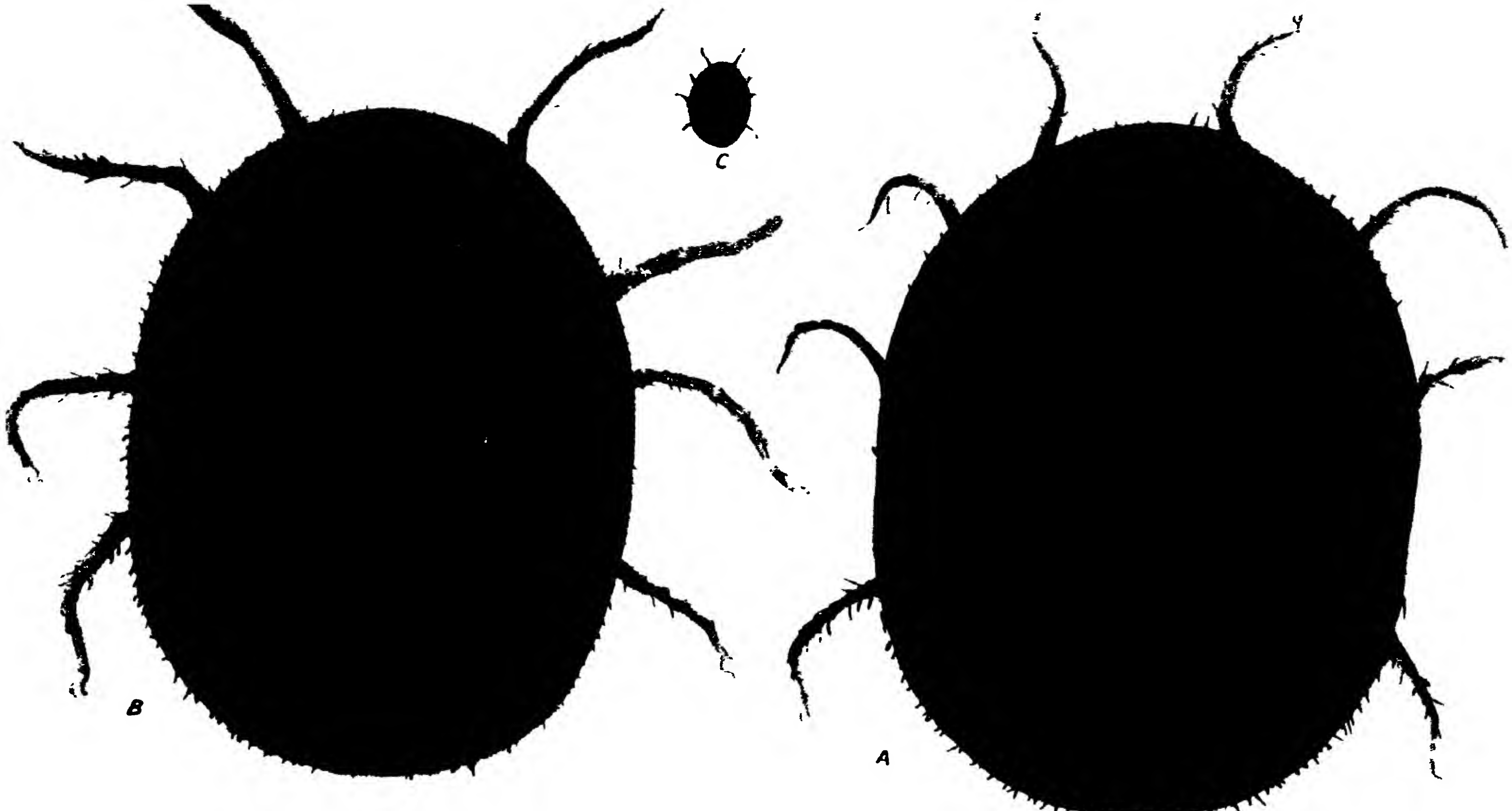

Plate CLXXIX

The Tampan.

(*Ornithodoros savignyi cæcus*)

A. Dorsal surface. *B.* Ventral surface. *C.* Tick, natural size.

Transvaal Agricultural Journal.

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TWO LITTLE-KNOWN TICKS OF THE TRANSVAAL.

By C. W. Howard, B.A., Acting Entomologist.

AMONG the nearly thirty species of ticks which are now familiar to specialists in South Africa are two about which little is popularly known. One of these, the Fowl Tick (*Argas persicus*), attacks fowls, and the other, the Tampan (*Ornithodoros savignyi caecus*), man and other animals. (Plate CLXXVIII.)

We often hear of fowls dying in a flock at the rate of eight or nine a day. The fowls seem free from disease, and no cause can be found for such an epidemic. A post-mortem, however, reveals the fact that none, or very little blood is left in the fowl, and, upon searching the cracks of the fowl house, the cause can easily be found in the numerous bed-bug like creatures, hiding away from the daylight, and each swollen to its fullest extent with blood. The fowls have died simply from loss of blood which these ticks have sucked from them. It is also thought that this tick may transmit some infectious disease of fowls, under certain circumstances, but this is not common and no absolute proof exists.

Argas persicus is very common throughout South Africa, and also occurs in Australia, India, Southern Europe and Persia. In the latter country it was first found and described. Early travellers in Persia tell wonderful stories of the prevalence of these creatures in the houses, making it necessary for the inhabitants to move frequently in order to escape its attacks. The bite was supposed to be poisonous, and to always result in death. In South Africa it bites people when occasion offers, but beyond the annoyance caused, no harmful results seem to follow. I heard, not long ago, of a Cape cart which had been left in an old fowl house and had become so full of fowl ticks, which hid under the upholstery, that no one was able to ride in it afterwards.

The usual animals attacked are fowls, geese, ducks, turkeys, pigeons, and, occasionally, man. Ostriches and canaries have also suffered on a few occasions.

The fowl tick resembles a bed-bug very much in shape, a fact caused probably by its mode of life, for they both conceal themselves in narrow cracks, making a very flat body necessary. The outline is elliptical, and, when unfed, they are of a light brown colour, with a lighter, almost translucent border from which translucent lines radiate toward the centre of the body. When fully fed the body becomes swollen and of a dark bluish-grey colour. Unlike the cattle ticks, there is no hard shiny shield upon the back of this tick next to the head, and, in addition, the head is not on the front edge of the body as with other ticks, but on the under surface, just in front of the first pair of legs, with the front end of the body projecting over it like a hood. The whole body of the creature is covered by a soft skin. When examined carefully, both the surfaces are beautifully marked with small shiny pits arranged in regular rows, mostly radiating from a central point. In addition, the margin is set off on both upper and lower surfaces by a rim of rectangular plates forming a very sharp, thin edge all about the body.

The eggs are small, dark reddish brown, shiny affairs, almost circular, and about 5 mm. (.02 inches) in diameter. These are laid in cracks and crevices about the fowl houses and under the bark of trees where fowls roost. As many as 120 eggs are laid at one time. These eggs hatch in from one to six weeks, depending upon the temperature.

The larvæ are quite different from the mature ticks. The body is still flat, but they are nearly round in outline, and the shiny pits are lacking; the mouth parts project beyond the front of the body, and there are only six legs, whereas the adult has eight legs. In colour they are almost translucent, with the exception of a slightly darker spot near the front end. This little larva finds a fowl or other host and inserts its beak to feed. At first it feeds slowly, but, at the end of the third day, begins to imbibe rapidly, and, by the fifth or sixth day, drops off. It at once seeks a protected crack in which to hide and digest its food, where, after about twelve days, it sheds its skin and appears in a new form. It is now known as a nymph, and appears exactly like an adult, except in size and in the absence of the external genital opening. From now on, it feeds only at night when the fowls are at roost, and only remains on for a short time, usually from half-an-hour to two hours, during which time it engorges and then drops off and seeks shelter again. In each interval it sheds its skin, and, after the fourth such visit, is mature. Thereafter, it visits a host about once a month, spending the interval in digesting the food and laying eggs. It is known to feed at least six times and deposit at least six lots of eggs before dying.

The vitality of the adult ticks is remarkable. They have been known to live in a vacant fowl house as long as thirty-seven months without food and still be capable of oviposition after a good feed, while they have survived twenty-seven months in an air-tight box. Larvæ have been kept eight months without food and still survived.

The ordinary method of combating bed-bugs with hydrocyanic acid gas is entirely ineffectual with fowl ticks. In the first place the

fowl house is usually very open and not suited to such treatment, and, besides, by actual experiments, we have found that a dose three times the strength used for the bed-bug (3 ozs. of cyanide to 100 cubic feet of space) kills only about one-fifth of the ticks.

A great many schemes have been devised by which the roosts are isolated from the walls, by inserting the ends or supports in tins of paraffin or other offensive fluid to prevent the ticks reaching the fowls when at roost, but all are more or less cumbersome or expensive. It is far simpler to spray or wash the interior of the fowl house with pure paraffin, taking special care to have it penetrate all the cracks. Paraffin is very deadly to all small creatures, the smallest drop quickly penetrating the body and causing death. Where fowls roost in trees and the bark of the trees furnishes hiding places for the ticks, the rough bark should be pulled off and the trunk sprayed lightly with paraffin. If this is done on a bright day and a very fine spray of paraffin is used, it will evaporate very rapidly before it has time to injure the tree.

It is often more convenient to paint the house, inside, with hot tar or hot whitewash. These substances fill up the cracks and smother the ticks and eggs hidden in them. Jeyes' fluid or corrosive sublimate mixed with the lime would make it more effective. This washing or spraying should be repeated once a week for two or three weeks in succession in order to destroy the larvæ which cling to the fowls several days. It is very important that all fowls brought into the flock should be quarantined for a week or ten days. In that time any larval ticks clinging to them will drop off, and the boxes in which they were quarantined should then be destroyed in order to kill such ticks.

The Tampan (*Ornithodoros savignyi caecus*), known as the Makarulu in the Sesutu language, is closely related to the fowl tick. It differs considerably in the appearance, however, as it is several times larger, attaining 12 mm. (.48 inch) or more in length, and not so flat. When fully fed it is quite round and plump. The colour is light brownish-blue, and the whole surface is covered with small granular papillæ. (Plate CLXXIX.)

This tick is found in many parts of South Africa, especially the drier and warmer parts, where it often becomes a great nuisance in the huts of natives and at outspanning places. In the latter places they conceal themselves under the bark of trees or in dry sand, coming out to feed on man or transport animals. It very often happens that a white man is forced to sleep in a native hut over-night, and is bitten by these ticks. Sometimes only slight irritation follows, but many times serious results. The portion bitten, for example, an arm or leg, swells to an enormous size and causes excruciating pain, vomiting and purging follow with general lassitude, and, frequently, blood poisoning follows with serious results. It has been thought that this was produced by some parasite which the ticks might transfer from one man to another, as East Coast Fever is transmitted by the brown ticks, but this theory seems quite improbable. Young ticks which had just hatched were fed on his arm by the writer with no results besides

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a slight swelling and irritation, showing that there was nothing harmful in the bite itself, and the symptoms seem to point to some poison such as the ticks might obtain from the unwashed skin of the last native bitten.

There is every reason to believe that the tampan of the Transvaal, although described under another name, is the same as the one (*Ornithadoros moubata*) which occurs in Rhodesia and the Congo region. In those countries the tick transmits a disease known as human tick fever. The cause is a small protozoan parasite known as a spirilla, which lives in the blood of the affected man, causing general lassitude, headache, and a high remittent fever. Livingstone describes the effect of the bite of the tampan along the Zambesi. He said that it caused first pain and itching, but when the effects reached the abdomen, vomiting and purging resulted, often followed by fever. The Portuguese stated to Livingstone that death sometimes resulted. In regions where it is common, natives seem to be immune from its attacks, probably due to the frequency of the bites, for they show no more annoyance from them than from bed-bugs, but to the stranger, or white man, they are quite different.

This question brings up the whole subject of insect bites. While some insects may be distinctly poisonous, that is, inject some virulent poison into the wound which they make, the vast majority of them do not. The poison is transmitted by the insects or ticks from one host to another, as the mosquito carries the malarial parasite from one host to another. For instance, one tampan may take up some parasite from the blood of one native which, when injected into the blood of another native or white man who is not immune, will cause disease; or it may take up some germ from the unwashed skin of one victim and carry it to another where the conditions may be favourable for the increase of this germ. It is probably in this latter way that the tampan of the Transvaal causes such annoyance.

The life history of the tampan is much the same as that of the fowl ticks, except in one respect. After hatching from the egg, the young larval tick scarcely moves about at all, and never feeds but curls up its legs and allows the entire skin to become hard. This finally splits off after about a week's time, and the eight-legged nymph crawls out and is ready to feed. From this time on it closely resembles the adult in colour and markings. The feedings are alternated with long rests and molts, or with egg laying when mature. Sometimes as many as three hundred eggs are laid at one time. Very little is known with regard to the distribution of this tick in the Transvaal, and any notes upon it will be most acceptable to the writer.

PUBLIC IRRIGATION WORKS FOR SOUTH AFRICA.*

By Sir William Willcocks, K.C.M.G., M.Inst. C.E.

THE Vereeniging Convention, which Mr. Chamberlain has called the Charter of the Transvaal and Orange River Colony Boers, was drawn up between two Western races to whom irrigation was an accident of existence and not the very foundation of stable wealth. If such a conference had taken place between two Oriental peoples, one of the first conditions of peace would have been the settlement of the question of water rights. To most Oriental races the land without the water is of little value, and control of the water implies control of the value of the land. In these respects South Africa is an Oriental and not a Western country.

The existing irrigation laws are considered bad by South Africans themselves. They appear to be well calculated to depress the value of every irrigation enterprise. However, before new legislation on sound lines can be profitably introduced, it is necessary thoroughly to understand and master the existing laws. For such mastery, local knowledge and local experience are necessary, and they should both be employed to thresh out eventually a good working Irrigation Act. To aid local knowledge, I have drawn up, in the Appendix of the Report on Irrigation which appeared in the Blue Book on South Africa, published in July, 1902, a draft Irrigation Act, embodying the salient wants which irrigation experience in Southern Europe, Western America and the East, has demanded. It is the duty of local legislators to draw up an Irrigation Act capable of being the charter of permanent prosperity in South Africa.

It would be a misfortune, indeed, if in the twentieth century were to be passed an Irrigation Act which overlooked the experience gained in India and Egypt, in Italy, Spain and France, and in the

*This paper was originally published in Volume I, No. 1, dated July 15th, 1903, of "Public Works," and is now reproduced in the "Transvaal Agricultural Journal" by the permission of the Author. The information contained in it was obtained by Sir Wm. Willcocks in 1901 during his tour throughout South Africa, in which, however, he was not able to see much of the Transvaal. The investigations of the Transvaal Irrigation Department show that, although irrigation schemes of the first magnitude are not practicable, several of fair size can be undertaken in many parts of the Colony, but at a greater cost, and therefore with smaller financial return, than anticipated by Sir Wm. Willcocks.—[W. L. Strange, M.Inst.C.E., Director of Irrigation and Water Supply.]

arid and semi-arid regions of North America. The main points to be legislated for are:—

(1) The classification of water rights according to their importance: as domestic, mining, and irrigation rights.

(2) The settlement and numeration, according to priority of right, of all existing water rights.

This would ensure existing irrigation works against being ruined by future works higher up the stream. The law as it stands at present does not protect a single irrigation work from ruin if owners of lands higher up the stream care to withdraw the whole of the water. The farms on the lower reaches of the Olifant's River, in the Oudtshoorn District, are a depressing object lesson of the want of such irrigation legislation in the Cape Colony.

(3) The approval and numeration of future irrigation works, so that they might clash neither with ancient nor with future works.

(4) Provision should be made for rotation of supply in years of drought. This would ensure a certain amount of crop to all in years of drought, and not allow some to have full harvests and others to be ruined.

(5) The creation of duly authorised bodies to carry the laws into effect.

In connection with this subject, I recommend the important publications of the United States Department of Agriculture, notably Bulletins 58, 60, 70 and 96. From these bulletins I give a few typical quotations:—

"Although the principle of the artificial use of water for irrigation on this continent is much older than the laws relating to land titles, the want of permanency of title to the water used in this way has been one of the greatest drawbacks to modern irrigation development."

"Colorado leads all the States in the production of the precious metals, but the yearly return from her irrigated fields is nearly double the value of the yearly output of the mines. On many rivers now there are a multitude of claims to the common supply. These rights have to be defined in some way. If laws do not define them, a resort to the Courts is all that intervenes between the just rights of water-users and anarchy. The growing volume of this litigation is a serious menace to progress. In ten years the water-right litigation of one State is estimated to have cost over a million dollars. In many sections it has exceeded the

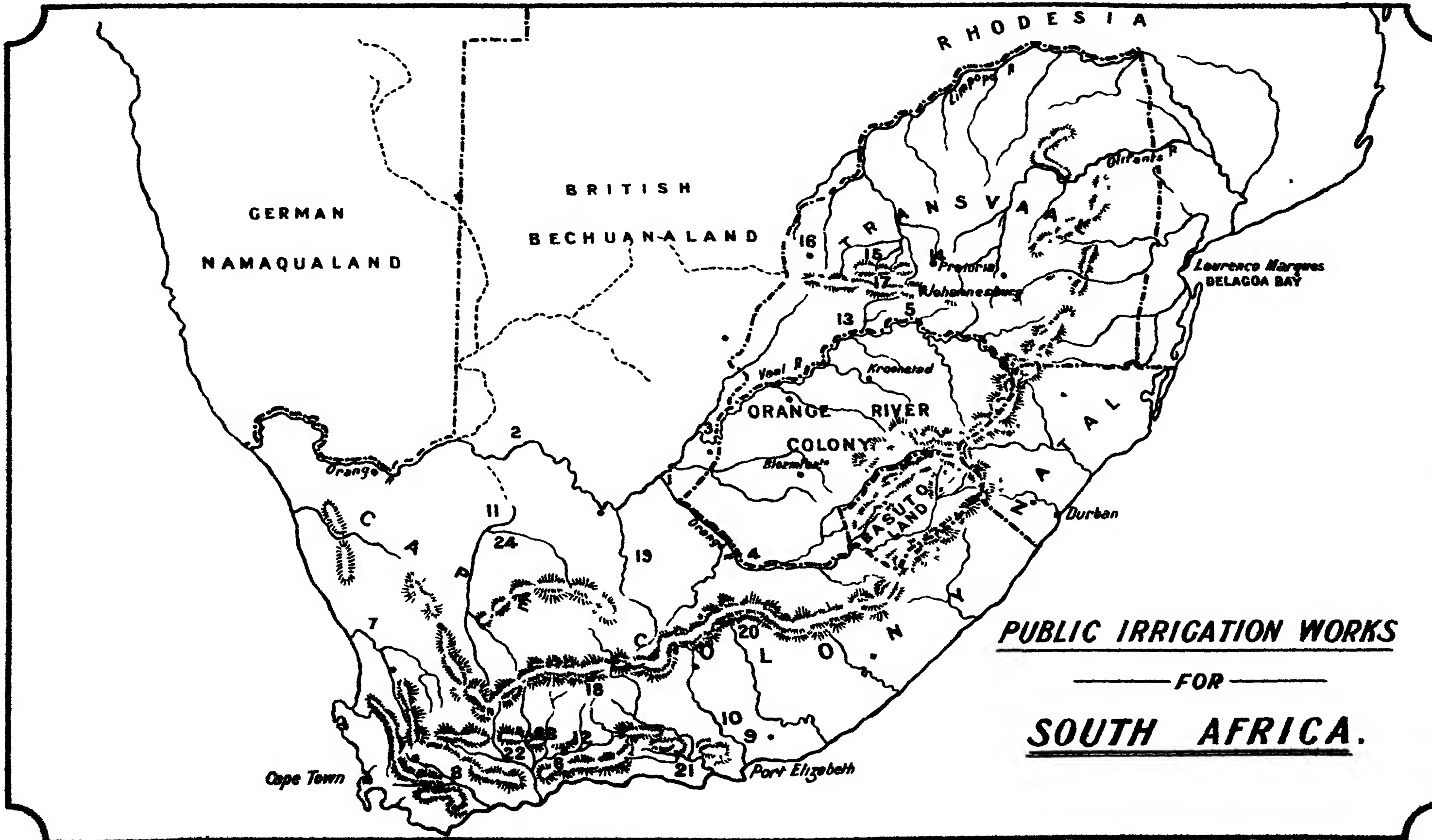
PUBLIC IRRIGATION WORKS
FOR
SOUTH AFRICA.
RHODESIA
GERMAN NAMAQUALAND
BRITISH BECHUANALAND
TRANSVAAL
ORANGE RIVER COLONY
BASUTO LAND
NATAL
CAPE COLONY
Laurenco Marques
DELAGOA BAY
Durban
Port Elizabeth
Cape Town
Pretoria
Johannesburg
Kroonstad
Vaal R.
Orange
Limpopo R.
Olifants R.
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Plate CLXXX.

money expended in constructing the ditches in which it has its origin."

"Litigation does not arise because irrigators desire it; it has its origin either in ignorance of the law or in its imperfections."

"The general Government aids settlers by publishing explicit directions for filing on public land and acquiring title thereto, but no such instructions have ever been issued to direct users of water in acquiring a right to the volume of water needed to give the irrigated home a value."

Bulletin No. 58 is by Mr. Elwood Mead, and is worthy of special study.

Another good book is "Irrigation Development," by Mr. W. Ham Hall, State Engineer to California. The latter book is a perfect mine of information on all matters connected with irrigation legislation in France, Italy and Spain.

A very suggestive work, entitled "L'Irrigation," has just been published by M. Jean Brunhes, of Fribourg University (G. Naud, 3, Rue Racine, Paris). In this latter book the different systems of water control and legislation which have been gradually developed in Spain, Algiers, Tunis and Egypt, are discussed historically and geographically. The general conclusion may be thus summed up:—Where water is scarce and frequently less than the demand, unlimited powers are gradually allowed to be assumed by those who have to control the water supply. In Valencia and other similarly situated localities, the irrigators themselves choose their own dictator whenever the water supply is insufficient, and obey his dictates as though he were a Czar. In the perennially irrigated tracts of Egypt the central authority has been gradually allowed to assume dictatorial powers, not only by the Egyptian Courts, but also by the mixed European Courts which are perfectly independent of the Government. Now, South Africa is distinctly a country of scarce and precarious water supply, and if irrigation is ever to succeed there, the most absolute powers must be vested in dictators chosen by the people themselves in each irrigation district or in the Central Government. No dictation, however absolute, is so cruel as chaos or anarchy in an irrigated country. Let the laws of South Africa vest absolute power in the central authority, or in a dictator chosen annually by the irrigators themselves, but let them vest it in somebody. Without some such settlement the south may certainly learn from the north that its arid and semi-arid lands will remain arid or semi-arid for all time.

Upon a foundation of good laws it will not be difficult to lay a

superstructure of useful irrigation works. Both my experience and reading encourage me in the belief that reservoirs and irrigation canals are the first works which an enlightened government should carry out in arid and semi-arid countries. During the recent severe droughts in Australia the railways and roads have not done one-tenth as much against the drought as good irrigation works would have done. With rivers such as the Darling, Lachlan, Murrumbigee and Murray, we hear of no canals, but we hear of intense suffering and distress which are as harrowing as they are harassing. New South Wales has spent £100,000,000 on communications, and £100,000 on irrigation works, and it is at the mercy of a severe drought after a century of civilised occupation just as though it were still in the possession of bushmen and aborigines. Even at the end of the long and terrible drought we read of academic discussions on navigation rights and possible improvements on the Darling River, when the drought has left little indeed on its banks to transport. "The rivers for irrigation and railways for transport" should be the motto for all dry countries. The distress we read of in Australia will be repeated among our new settlers in South Africa whenever the lean ears, blasted by the east wind, come round in their unfailing rotation, unless, indeed, in the meantime, public canals and reservoirs worthy of the name have been constructed and brought into working order. Let the Government encourage, by every means in its power, the execution of irrigation works by companies, associations, syndicates and landed proprietors, but let it by no means slack its hand. Successfully executed irrigation works not only bring in direct revenue to the State, but they show the way to capital, which is ever timid and costly in novel enterprises.

The necessity for irrigation in South Africa generally lies in the fact that the high-lying plateau of South Africa has, by its situation, a rainfall suited to tropical countries, and, owing to its altitude, a climate which belongs to a temperate zone. The autumn rains of February and March, which are monsoon rains, would, in a country like India, be of infinite value; but, followed as they are in South Africa by a severe and biting winter, they are of little value indeed for agricultural purposes. The long winter and spring drought and the uncertain summer rains absolutely prohibit agriculture of any advanced kind without the aid of irrigation. In the south-west corner of Cape Colony, the "conquered territory" of the Orange River Colony, in Basutoland and in limited areas of the Transvaal, it is possible to grow wheat without irrigation. Moreover, in the eastern districts of the Cape Colony, in the north-eastern half of the Orange River Colony and in the Transvaal generally, it is possible,

in ten years out of eleven, to grow Indian corn, potatoes, roots and pumpkins for feeding stock with the aid of the rainfall. In these more favoured tracts an intelligent application of crop rotation, suitable manures and good tillage would do much for the country, and would, in ten years out of eleven, suffice for an agricultural development of no mean value, especially if taken in conjunction with stock breeding, which will always be the principal industry of the country. But, even here, nothing but irrigation will insure against famine in the eleventh year. And mind, this has to be said of the most favoured tracts. What shall we say of the rest of the country where the water comes at a time when it is of no value to agriculture, and is almost invariably absent when it is indispensable?

Until one travels in South Africa one has but a small idea of the height of the country. As you proceed northwards from Capetown up the Johannesburg railway, you rise from sea-level to a plateau of 2,500 feet above sea-level between Matjesfontein and Beaufort West, and then from Victoria West to Colesberg to a plateau of about 4,000 feet above sea-level. You enter the Orange River Colony at 4,000 feet, and you leave it at 5,000 feet. Johannesburg is 5,800 feet, and between Pretoria and Middelburg you are about 5,000 feet above sea-level. From Capetown to the east of Worcester the country consists of alternate hills and valleys, where the rainfall is fairly seasonable. From Worcester to the Orange River you are in the Karoo. The Utivigua range and its continuations intercept the south-east winds, and allow very little rain to fall in the Karoo. The Nieufeld range still further diminishes it. The whole country is dry and treeless.

In nearly the whole of Cape Colony and the south-west corner of the Orange River Colony there is a considerable amount of lime and salt in the soil, and irrigation needs to be skilfully conducted in all lands except the rich alluviums of the rivers. In the south-western corner of Cape Colony, the greater part of the Orange River Colony, Basutoland, and a great part of the Transvaal, the soil is sandy, and lacks both salt and lime. The richest parts of South Africa are situated in the dolomite formation. Here there are numerous springs of perennial water, and in South Africa perennial water, when you see it, means money. Around the perennial springs are situated orchards, alfafa fields, tobacco plantations, gardens and broad stretches of wheat. Speaking in a general way, ordinary unirrigated land in South Africa may be taken as varying in price between 2s. per acre and £3 per acre, with an average of 5s. per acre for Cape Colony as a whole, 15s. for the Orange River Colony, and 10s. per acre for the Transvaal. I regret that I know nothing of Natal and Rhodesia. Irrigated land may be taken as worth £20 per acre as a minimum, and £100 per acre as a maximum, except in especially favoured localities. £50 per acre may be considered as a fair price for good land provided with perennial irrigation. It would be unwise, indeed, to provide perennial irrigation for any land which is not very good.

The following tables give the rainfall in typical places in South Africa in 1895, 1896, 1897:—

RAINFALL IN INCHES, 1895.

No.	Station.	Height above Sea Level.	January.	February.	March.	April.	May.	June. (Mid winter.)	July. (Mid winter.)	August.	September.	October.	November.	December.	Total.	Difference from Mean.
1	Capetown ...	40	·8	—	1·1	3·4	3·8	3·5	1·8	3·3	5·6	2·9	1·4	·9	28·5	+ ·5
2	Robertson ...	600	2·7	·1	·2	·8	·8	·6	·4	·5	1·5	·4	·1	·8	8·8	— 4·3
3	Oudtshoorn ...	1,100	2·6	·1	·4	·8	·3	·7	·2	·1	·3	·6	·4	1·0	8·3	— 2·1
4	Beaufort West ...	2,900	4·6	—	·3	2·8	·5	·2	·2	—	·1	·2	·2	·3	9·3	— ·4
5	Graaff Reinet ...	2,500	2·2	1·7	3·1	2·1	·8	—	—	·1	·7	·3	·8	1·0	14·8	— 4·0
6	Calvinia ...	3,100	·5	—	1·1	·7	1·9	·1	·6	·7	·3	·2	·4	·1	6·6	— 2·1
7	Carnarvon ...	4,100	1·4	·3	·6	2·6	·7	—	·1	—	—	·2	·3	·9	7·1	— 2·8
8	Colesburg ...	4,400	2·1	3·6	2·2	2·8	1·4	—	·4	—	—	·1	2·2	4·4	19·2	+ 1·0
9	Pella ...	1,800	—	—	1·1	·1	—	—	—	—	—	—	—	—	1·2	— 2·6
10	Kenhardt ..	2,700	·4	·3	·8	3·5	—	—	—	—	—	—	·3	1·4	6·7	— ·1
11	Prieska ...	3,300	1·0	·8	1·4	3·3	·9		—	—	—	—	·5	1·7	11·6	+ ·2
12	Kimberley ...	4,000	1·0	2·4	1·6	3·9	1·2		·1	—	—	—	2·6	2·8	15·8	— 3·6
13	Grahamstown ...	1,800	3·8	4·9	4·5	2·9	·9	·2	·4	1·0	1·7	3·8	1·9	2·4	28·4	— 1·3
14	Herschel ...	5,100	3·4	3·9	5·0	3·0	1·2	—	·6	·1	·3	·1	1·8	6·9	26·3	— 3·7
15	Kokstad	4,300	3·0	6·0	5·9	1·5	·1	—		—	·3	·8	·8	8·4	27·0	— 2·7
16	Maseru ...	5,500†	3·3	9·8	9·8	1·9	2·3	—	—	—	—	·2	3·3	8·8	39·4	+ 7·6
17	Bloemfontein ...	4,500	3·4	7·5	4·5	3·4	1·6	—	·2	—		·4	5·7	6·5	33·1	+ 7·7
18	Kroonstad ...	4,500	2·3	3·8	3·1	3·5	·6		—	—	—	2·7	5·0	4·0	25·1	— 2·1
19	Smithfield ...	4,400	3·1	7·0	2·0	2·8	·8	—		—	·3	—	·7	6·8	23·6	— 1·7
20	Johannesburg ...	5,700	3·8	4·6	7·0	2·0	·2	·1	—	—	·3	·1	4·0	7·0	29·1	— ·9
21	Rustenburg ...	3,900†	5·8	6·8	10·5	1·8	·4	—	—	—	—	·2	6·5	8·1	40·0	—
22	Vryburg ...	4,300	4·7	1·3	5·3	6·0	·6	—	—	—	—	1·4	—	—	—	—
23	Hopefontein* ...	4,700	5·6	9·3	4·0	·2	—		—	—	—	·2	4·7	10·6	34·7	—
24	Durban ...	260	5·7	10·2	11·1	4·5	1·3	·1	·8	·6	1·6	2·6	1·9	11·2	51·5	+ 9·0

* Matabeleland. † The heights of Maseru and Rustenburg are approximate.

Rainfall in Inches, 1896.

Mid-winter.

No.	Station.	Height above Sea Level.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Difference from Mean.
1	Capetown	40	1·0	·4	1·6	·6	2·5	3·5	2·2	2·3	1·3	·9	·8	–	17·1	—10·9
2	Robertson	600	·3	1·0	·4	1·2	2·4	1·1	·3	1·3	·9	·4	·7	—	10·0	— 3·1
3	Oudtshoorn	1,100	·3	1·2	·1	·1	·9	·9	·2	2·5	·4	·5	1·1	·2	8·5	— 1·9
4	Beaufort West ...	2,900	1·1	1·9	·4	·2	·3	·3		1·6	·1	·4	2·3	·3	8·9	— ·8
5	Graaff Reinet	2,500	1·0	1·7	2·0	·7	1·6	·3	–	3·0	·2	·4	4·5	1·0	16·5	— 2·3
6	Calvinia	3,100	·1	—		1·1	1·0	·4	·3	1·1	·2	·4	1·2	—	5·8	— 2·9
7	Carnarvon	4,100	·3	·6	·6	·7	1·0	·2	—	·1		·6	2·2	1·2	7·3	— 2·6
8	Colesburg	4,400	1·0	2·2	1·0	2·6	1·5	1·1	·1	·4	–	—	·6	3·0	13·4	— 4·8
9	Pella	1,800	·1	·1		·2			—	·7		—	—	—	—	—
10	Kenhardt	2,700	–			·1	·6	–	—		–	—	·3	2·0	—	—
11	Prieska	3,300	—	·3	·3	1·5	·5	·6	–	—	—	—	·4	—	—	—
12	Kimberley	4,000	1·1	·7	2·6	3·2	2·1	·6		·3	—	—	1·1	6·8	18·5	— ·9
13	Grahamstown	1,800	2·3	1·8	1·4	1·8	·8	1·2	·6	2·5	2·8	2·7	6·8	3·0	27·7	— 2·0
14	Herschel	5,100	1·9	2·2	1·5	2·4	2·1	·6		1·3	·4	–	1·6	10·7	27·7	— 2·3
15	Kokstad	4,300	1·6	3·9	1·9	1·7	·5	·3	·4	1·3	1·0	1·8	4·4	9·5	31·5	+ 1·8
16	Maseru	5,500†	1·7	3·6	1·9	4·5	2·9	·9		2·7	—	1·2	1·6	10·5	31·4	— ·4
17	Bloemfontein	4,500	·8	1·9	1·4	2·7	2·2	1·0		1·7		·5	1·0	6·4	19·6	— 3·8
18	Kroonstad	4,500	1·7	2·3	·6	3·6	·9	·3	–	1·5	·7	·8	2·3	4·2	19·1	— 8·1
19	Smithfield	4,400	·8	1·2	1·1	·8	2·5	·6	—	3·6	–	–	·4	9·0	20·1	— 5·2
20	Johannesburg	5,700	1·6	3·7	2·0	1·7	1·3	·6		·8	·5	2·4	2·4	6·2	23·2	— 6·8
21	Rustenburg ...	3,900†	–		–				–		—	—	—	—	—	—
22	Vryburg	4,300	2·0	2·6	1·7	1·8	2·0	·2	–	·7	·5	·5	·1	5·8	17·4	— 8·0
23	Hopefontein*	4,700						–	–	—	—	—	–	—	—	—
24	Durban	260	3·0	3·8	4·3	5·3	1·0	·1	·7	1·3	3·9	5·3	4·3	6·6	39·6	— 2·9

* Matabeleland. † The heights of Maseru and Rustenburg are approximate.

RAINFALL IN INCHES, 1897.

No.	Station.	Height above Sea Level.	January.	February.	March.	April.	May.	June. (Mid winter)	July. (Mid winter)	August.	September.	October.	November.	December.	Total.	Difference from Mean.
1	Capetown	40	·4	·9	·7	·9	1·9	1·9	5·0	2·9	2·5	1·9	·7	·6	20·2	— 7·8
2	Robertson	600	·3	·1	·8	·5	·1	·6	1·7	·6	1·0	1·0	·1	—	7·9	— 5·2
3	Oudtshoorn	1,100	·3	1·5	·5	—	1·7	·2	·1	—	1·9	1·3	·5	—	8·1	— 2·3
4	Beaufort West	2,900	—	·1	·6	·1	1·4		·2	—	1·5	1·0	-	1·1	6·1	— 3·6
5	Graaff Reinet	2,500	1·9	·6	2·6	·3	3·3	·2		—	1·7	·3	·6	·8	12·2	— 6·6
6	Calvinia	3,100		·6	·9	·4	1·1	·5	1·0	·2	·5	·4	·1	·1	5·7	— 3·0
7	Carnarvon	4,100	·6	·1	·0	·4	·7	—	—	—	·2	—	—	·2	2·2	— 7·7
8	Colesburg	4,400	2·8	1·2	1·6	·5	·6		—	·5	·1	·2	—	·8	8·2	—10·0
9	Pella	1,800	·3	—	·2	·3	1·9		—	—	—	—	—	—	2·6	— 1·2
10	Kenhardt	2,700	·8	·3		·2	·2	—	—	—	—	—	—	—	1·4	— 5·4
11	Prieska	3,300	3·2	—	·5	·4				—	—	·3	—	·3	4·6	— 6·8
12	Kimberley	4,000	2·3	1·0	4·3	·7	·1		—	·1	—	1·3	—	·7	10·5	— 8·9
13	Grahamstown	1,800	1·5	·7	2·1	2·4	3·0	4·1	·6	·5	2·6	3·5	4·6	2·0	27·5	— 2·2
14	Herschel	5,100	5·9	2·1	4·0	1·9	·3	—	—	·5	—	1·8	·1	2·7	19·2	—10·8
15	Kokstad	4,300	4·2	3·1	4·6		·5	4·3	—	—	·4	1·3	·6	3·5	23·5	— 6·2
16	Maseru	5,500†	7·0	1·7	4·8	1·4	·2		—	·2	·1	2·6	·1	2·7	20·7	—11·1
17	Bloemfontein	4,500	8·6	·7	2·5	·9	—	—	—	·1	·1	3·4	—	·6	17·1	— 8·3
18	Kroonstad	4,500	4·6	3·0	3·4	1·0	·6	—	-	·9	·9	·4	·2	1·9	17·0	—10·2
19	Smithfield	4,400	7·0	2·1	3·2	1·0	·6	-	—	—	—	1·1	—	3·9	19·0	— 6·3
20	Johannesburg	5,700	9·7	5·0	3·9	·6	·5		—	·2	·1	3·3	2·2	3·5	29·0	— 1·0
21	Rustenburg	3,900†			-	—			—	—	—	—	—	—	—	—
22	Vryburg	4,300	1·7	1·2	5·7	·6		—	—	—	—	·6	—	1·3	11·1	—14·4
23	Hopefontein*	4,700			—	—	—		—	—	—	—	—	—	—	—
24	Durban	260	3·9	1·5	5·8	1·1	·3	3·8	—	·9	4·7	4·8	3·0	4·6	34·4	— 8·1

* Matabeleland.

† The heights of Maseru and Rustenburg are approximate.

Monthly Averages of Daily Readings of Maximum and Minimum Thermometers up to 1898.

No.	Station.	Height above Sea Level	Jan	Feb	March.	April	May.	June.	July.	Aug	Sept.	Oct.	Nov.	Dec.	Mean.
1	Capetown ...	40	81 60	81 60	79 58	72 54	66 50	63 48	62 46	63 47	66 49	70 52	74 55	77 58	71 Max. 53 Min.
2	Worcester	770	86 59	86 60	84 57	75 51	68 47	65 43	63 40	65 42	70 46	74 50	79 53	83 56	75 Max. 50 Min.
3	Port Elizabeth	180	76 64	76 64	75 62	72 58	70 54	68 51	67 49	66 51	67 53	68 56	71 58	74 61	71 Max. 57 Min.
4	Prince Albert	2 100	83 60	80 55	73 51	69 47	64 44	62 40	62 39	65 41	71 46	74 51	80 58	82 59	72 Max. 49 Min.
5	Kimberley	4 000			86 59	79 32	71 44		— 	72 42	80 49	85 54	89 58	92 62	— Max. — Min.
6	Graaff Reinet	2,500	88 58	88 60	83 57	76 50	71 44	69 40	67 37	70 40	75 45	79 50	83 53	87 57	78 Max. 50 Min.
7	Aliwal North	4 300	83 56	83 56	78 52	72 44	66 36	62 29	62 28	66 34	72 40	77 46	80 50	84 57	74 Max. 44 Min.
8	Bloemfontein	4 500	86 59	85 59	81 54	75 48	68 37	64 31	65 30	69 35	76 42	81 49	84 53	87 57	77 Max. 46 Min.
9	Johannesburg*	5,700	77 54	82 55	78 53	78 48	70 42	64 34	67 35	72 42	77 44	82 53	85 53	84 57	Av. Max. Av. Min.
	Johannesburg†	5,700	90 47	93 49	88 46	82 36	77 36	74 26	74 27	82 30	88 32	89 45	96 36	95 51	Abs. Max. Abs. Min.

* Johannesburg for 1897 only. † Absolute Maximum and Minimum readings.

This information has been taken from the reports of the Meteorological Commission of Cape Colony, from figures supplied me by Mr. Sloley, the Commissioner of Basutoland; by Mr. G. A. Northcroft, Chief Engineer of the Orange River Colony; and by Mr. E. H. V. Melville, of the Consolidated Gold Fields, Johannesburg. I have purposely chosen these years as they comprise one of the worst droughts ever known in South Africa, and when considering perennial irrigation with European colonists we must be prepared to tide over the worst years. European settlers will not patiently die in millions like Orientals, and, unless we can provide for such years, we had better not make settlements for Europeans. The rainfall tables are followed by a table giving information about temperatures which will be useful when agricultural questions are considered. I should remark here, in passing, that the rainfall in places like Robertson and Oudtshoorn, which are in the valleys, is less than half of what it is in the high hills which hem in the valleys.

It would be well, indeed, if the South African Governments, before finally approving of any large irrigation schemes, were to take warning from the disasters which have overtaken mis-applied irrigation in some of the Western States of America, and to institute soil surveys of all lands to be traversed by canals before the works are put in hand.

Such operations would, indeed, occupy very little time, and cost under £1 per square mile. In the "Field Operations of the Division of Soils," for 1900, published by the United States Department of Agriculture, will be found most instructive reading from page 208 to the end, especially instructions in a paper by Mr. Thos. H. Mea, on the Salt River Valley of Arizona. The extraordinary development of "alkali" or "brack" which has followed irrigation in some of these lands is full of warning. The white alkalis or sulphates or nitrates of soda and potash can be counteracted, while the black alkalis or the carbonates are, so far, ineradicable.

To enable myself to advocate reliable systems of irrigation in South Africa by the aid of experience acquired in other countries, I have made myself thoroughly familiar with the prominent works and projects which have been executed and brought forward locally. Such works and projects are described very fully in the interesting annual reports of the hydraulic engineers of Cape Colony; in special reports kindly supplied me by Mr. Newey, the present Chief of the Public Works Department at Capetown; by Mr. Litchfield, of Kimberley; Mr. Northcroft, Chief Engineer of the Orange River Colony; Mr. St. Vincent Erskine, of Bloemhof; Mr. George Kilgour, Mr. Arthur Goldhawk and Mr. Sedgwick Wooley.

The works and projects can be divided into four categories (the numbers attached to the works will be found on the plan of South Africa accompanying this article) :—

A. Irrigation Works on the Orange and Vaal Rivers.

1. The Douglas Canal on the Vaal—£21,000 for 1,300 acres.
2. The Uppington Canal on the Orange—£2,300 for 1,300 acres.

3. The Hartz Valley scheme on the Vaal—£350,000 for 35,000 acres.
4. The Odenalstroom scheme on the Orange—£65,000 for 1,300 acres.
5. The Vereeniging scheme on the Vaal—£75,000 for 11,000 acres.

B. IRRIGATION WORKS AND PROJECTS ON MINOR RIVERS.

6. The Oliphants' River Irrigation at Oudtshoorn—10,000 acres.
7. The Oliphants' River Irrigation at Clanwilliam.
8. The Brede River Canal at Robertson—£40,000 for 2,000 acres.
9. The Sundays River scheme—£50,000 for 6,000 acres.
10. The Tigerpoort scheme on Sunday River.
11. Kenhardt Dam on the Hartbeest River—£17,000 for 1,000 acres.

C. IRRIGATION WORKS ON SPRINGS.

12. Grobelaars River at Oudtshoorn—4,000 acres.
13. Mooi River at Potchefstroom—6,000 acres.
14. Pretoria—5,000 acres.
15. Rustenburg—1,000 acres.
16. Zeerust.
17. Hekpoort.

Trifling weirs and small canals.

D. IRRIGATION WORKS ON SMALL STREAMS.

18. Beaufort West Reservoir—£14,000 for 200 acres.
19. Houwater Reservoir—£11,000.
20. Steynsburg project—£22 per acre.
21. Gamtoos project—£136,000 for 13,000 acres.
22. Calitzdorp project.
23. Grobelaars River project—£440,000 for 18,000 acres.
24. Van Wyks' Vlei Reservoir.

We may say that the provision of irrigation in South Africa, on the small scale so far practised or advocated, will cost from £10 to £40 per acre. Every system of irrigation practised in the world is advocated in one or other of these schemes. The rates of pay are excessive for such easy work. They are: For earthwork labourers, 2s. to 3s. 6d. per day; and for masons, quarrymen and carpenters, 12s. to 17s. 6d. per day. South Africa is eminently the country for labour-saving machinery and for imported labour for earthwork.

In South Africa I estimate that each acre of perennially irrigated land in the Karoo will need 250,000 cubic feet of water in the reservoir ; the quantity will decrease steadily as one advances in a north-east direction, until, in the Transvaal, 160,000 cubic feet will suffice. Taking count of the rainfall, I also calculate that, in the north-western Karoo, one acre of perennial irrigation will require one square mile of catchment basin; in the eastern Karoo one square mile of catchment basin will suffice for four acres; in the south-eastern

parts of the Orange River Colony and the Transvaal one square mile will suffice for ten acres; while in the north-east of the Orange River Colony and the Transvaal generally, one square mile of catchment basin will suffice for twenty-five acres of perennial irrigation.

The public irrigation works I should propose for South Africa, and the principles on which I should advocate them, are as follows :—

(1) The execution of large and important canals, each capable of irrigating at least 200,000 acres, such canals to be taken from the Orange or the Vaal, which never fail and which will never give cause for anxiety. The canals should be led out of the rivers from above overflow solid dams of the type of the Betwa dam in India. These dams should be from 30 to 50 feet high, and should be constructed of the most solid masonry. The canals would at once begin to command the country and should store water either in pans or in natural depressions outside the rivers. Where possible, irrigation should be given freely to the flat vales. The direct irrigation with the muddy waters of the rivers would be a basin irrigation, which would produce crops as rich as those we see on the Oliphants' and Zak Rivers of Cape Colony. Water rates should be fixed for basin irrigation and for perennial irrigation separately, and the Government should be as little nervous of getting a ready sale for its water as it is of getting a ready sale for its first and third class railway tickets. Most of the schemes in South Africa seem so cramped and microscopical. Why should not a right bank canal from the Vaal River be taken boldly across the Hartz River into Bechuanaland or wherever the levels would allow it? Why should not a left bank canal be taken past Hoopstadt and Kimberley? The Ganges canal in the first thirty miles of its course crosses rivers and torrents by the side of which South African streams are but as children. Canals from the Orange River above Hopetown to Prieska, and from above Prieska to Kenhardt should certainly be attempted. It might be possible to feed the lower reaches of the Hartbeeste River with water from the Orange, and to feed the Kenhardt reservoir also with water from the Orange under happier auspices. Rich, muddy water from the Orange River should produce crops of things other than salt, if such water could find its way even into Van Wyks' Vlei. Then there is all that country on the north bank of the Orange River which is represented as a white sheet of paper on most maps. It is easier, safer, and far more economical to have to do with a river discharging 500,000 cubic feet per second, and a canal discharging 5,000 cubic feet per second, than to have to do with a river discharging 160,000 cubic feet per day. In these small works the water is almost as dear as though it were actually stored in casks of a certain number of gallons capacity. With so much

activity and enterprise in the mining and railway world, why drag the chariot wheels of those who have to do with irrigation works? The modern world, under the guiding hand of the great European races or their descendants, has, indeed, been slow to adopt irrigation, that oldest of old-world sciences. The roads and railways, and the mines and factories of Europe are taken to every land, but the northern European, transferred to an arid land, stands hesitating before that science which was hoary with age thousands of years before railways were dreamt of.

(2) Training weirs on the more important muddy rivers of the Karoo and semi-Karoo should be quite a feature of the country. Such weirs should be improved types of those on the Oliphants and the Zak. They should be permanent. All the mud brought down by the rivers in flood should be deposited on the lands bordering the rivers, and should be a medium for producing rich crops of cereals. No alluvium should be allowed to find its way to the sea. This system of irrigation needs to be introduced on a large scale to be thoroughly appreciated. No brack lands accompany such irrigation.

(3) Storage dams with training weirs might profitably be constructed on the larger rivers of the Orange Colony and the Transvaal. Where the rivers have cut deep trenches in the soil they should be brought up to a higher level with masonry weirs from 20 to 30 feet high, built on the rocky dykes which traverse these rivers at such frequent intervals that Mr. Northcroft, Director of Public Works in the Orange Colony, can thus write of them: "There are no maps expressly showing dykes. These occur at very frequent intervals on the streams within the Colony, and it may be generally be taken for granted that not more than ten miles intervenes between any two of them." When pans or natural depressions exist, they are nature's reservoirs which should be filled wherever possible. The creation of numerous deep pools and lakes of fresh water, fresh from its depth and its frequent renewal, would change the whole face of the country and even of its vegetation, and might even affect the rainfall.

(4) The very last works for the Government to undertake should be those of the kind mentioned in category D. They are always expensive, cause law suits if not constructed by the interested parties themselves, and sometimes do as much harm to existing irrigation as they do good to the new lands brought under cultivation. Such works should be constructed by the interested parties themselves with the aid of State loans on very favourable terms.

Summing up, I should say that the Government would do wisely to begin with the largest and boldest works on the largest rivers. Such works, if wisely conceived, will always pay. An expenditure of £5,000,000 on important works on the Orange and the Vaal would probably suffice for the irrigation of 750,000 acres. Of this area, one-third might be provided with perennial irrigation, and two-thirds with flood irrigation. A rate of £1 per acre per annum for the first, and 10s. per acre per annum for the second, would bring in a gross return of 10 per cent., or net return, allowing for maintenance, of 5 per cent. on the capital. If such works were a success, the "poor white" question would be settled for many generations. Next, in point of interest, come the works on the larger rivers of the second category. Training weirs should cost £5 per acre, and storage dams £10 per acre irrigated. Both would then pay 5 per cent. interest if they were undertaken in a bold and comprehensive way. Works of the fourth category (D) will never pay the Government directly, though they may pay as famine protective works. These, as I have already stated, are best left to private enterprise aided by State loans at a low rate of interest.

Let the South African Governments confine themselves to the boldest projects on the largest streams, and irrigation works will, in time, prove themselves a surer and safer investment of public money than any roads or railways in so dry a country as that we are now contemplating. (Plate CLXXX.)

VETERINARY SCIENCE IN ITS RELATION TO AGRICULTURE.

By Lieut.-Colonel L. J. Blenkinsop, D.S.O.

When we remember that the basis of all agriculture is stock, and that veterinary science treats of stock both in health and disease, we can fully appreciate that this science cannot be separated from agriculture. In fact, in all stock-rearing countries it is the most important of the many branches of science which are grouped under the head of agriculture.

From the earliest times, agriculture and veterinary science have been closely associated. The first known writers in agriculture also wrote on the diseases of animals. The importance of the study of domesticated animals was fully appreciated in the most ancient times. History gives us evidence that the Egyptians practiced veterinary medicine and surgery. Hippocrates, who wrote in the fifth century before Christ, gives us definite information regarding the care and treatment of animals in health and disease. Diocles of Caristus was one of the first to study the anatomy of animals. Aristotle wrote on physiology and comparative anatomy, and also on diseases affecting animals. Many other Greeks wrote on the different branches of veterinary science. Xenophon's work on horse mastership is still one of the soundest of the elementary books on this important subject.

In the first century we find the Roman Columella writing a remarkable book, which not only deals with the treatment of diseases in animals, but also on sanitary measures for their suppression.

From the third century veterinary science had a literature of its own, and became recognised as a very important branch of the different sciences bearing on public economy. There were regular veterinary practitioners in the Roman army, and many men such as Apsyrtus of Bithynia, Hierocles and Publius Vegetius founded methods in the treatment of injuries, hygiene and control of disease, which remain in use to the present day, not only in the treatment of the lower animals, but also in medical practice.

All through the middle ages, veterinary science flourished in Southern Europe. In the 15th and 16th centuries we find the earliest German works, and about the same time the subject is treated in English literature. These earlier works all show traces of Italian influence. Unfortunately the study of animal disease was at this period almost entirely confined to the horse, and, as in human medicine, where the surgeon was closely associated with the barber, so in veterinary practice the veterinary surgeon was frequently allied to the farrier. As the knowledge of pathology, physiology and anatomy became more scientific, it was found that the barber could no longer grasp the knowledge gradually being required of a surgeon. In exactly the same way the farrier gradually dropped away from the veterinary treatment of animals.

At the present time in all civilized countries the practice of veterinary science is confined to specially educated men, who have passed a regular course at a recognised veterinary college, and obtained a special licence to practice as veterinary surgeons. This is the outcome of modern civilization, which will not brook animal suffering at the hands of untrained and uneducated men, who from ignorance are very often the cause of the grossest cruelties.

The advantages reaped by agriculturists in different parts of the world, from the work of the educated veterinarian would appear to have hardly been fully appreciated by the ordinary public. When we look back and find animal scourges entirely eradicated from stock in different countries where the teaching of veterinary science has been listened to, we can only wonder that those countries where animal diseases still exist, do not do more to foster the veterinary practitioner. In England, within the memory of many, such diseases as rinderpest, foot and mouth diseases, pleuro-pneumonia and rabies have been completely stamped out. In Ireland most contagious diseases of stock have disappeared, while on the Continent of Europe animal scourges are rapidly being brought under control.

During the last quarter of a century our knowledge of animal diseases has made rapid advancement, and now we are able to approach the question of eradiction of animal plagues on far more economical lines than we did a quarter of a century ago.

Pasteur was the first to teach us the use of bacteriological preparations for the inoculation of stock against disease, and in the following out of his teaching we have had some of the most brilliant discoveries. The preparation of mallein for the eradication of glanders, tuberculin for the diagnosis of tuberculosis in stock, are only two of the very many discoveries which have been made since Pasteur first blazed a track through the then unknown regions of a new science. Such men as Nocard in Paris, Sir John MacFadyen in London, and Theiler in Pretoria, following on Pasteur's teachings have all in their own countries made discoveries which entirely eclipsed those of the earlier veterinary investigators.

The study of animal disease has now become an accurate science, which can only be taken up after a very careful and special education. It can hardly be fully appreciated by the unitiated, and the realization of the benefits which result from following its teachings, are only now becoming realized by the general public. This is more especially the case in a rural country like South Africa, where until comparatively recently many of the diseases affecting stock were very ill understood. The work of such men as Hutcheon, Theiler, Koch and Bruce has done more for the benefit of the stock owners of this country than any other branch of agricultural science.

This statement is made in no way to disparage the work done by workers in other branches of agriculture, but the public are very apt to overlook the scientific work of men who make discoveries by which contagious diseases can be combated, and stock given immunity against

diseases which render farming a very risky, if not an absolutely unprofitable, undertaking. The safe-guarding of stock against disease in an agricultural country is one of the most economical ways in which public money can be spent. But if satisfactory results are aimed at, a properly organised and fully equipped veterinary staff is absolutely necessary.

A campaign against disease must be carried through in no half-hearted and doubting way. The stock in a country represents a very considerable amount of money, and to secure it against loss it is necessary that a certain percentage of its value should be invested for its protection. The eradication of stock diseases can only be carried out economically by an efficient Veterinary Department working on scientific lines, and with the support of the public.

An efficient Veterinary Department means money. In every country where a properly organised Veterinary Department has been given sufficient support to enable the necessary steps to be taken for the eradication of animal disease, these diseases have been brought under control.

Any money spent has been repayed with interest, and the fact that a country is free from stock diseases not only ensures the prosperity of its agricultural industries, but makes its stock sought after in the world's markets. No country will risk importation of diseased stock without insuring against the introduction of disease amongst its home stock, and this can only be done by placing restrictions on the incoming animals. Such restrictions limit the markets open to a country whose stock is not free from animal scourges, and greatly diminishes the foreign demand for its animals.

This depreciation of the market value of stock always interferes with the agricultural prosperity of a country. Hence before the improvement of the breeds of stock in a new country is seriously undertaken, it is most important that animal disease should be carefully brought under control. This is best accomplished by legislation, restricting movement of stock in areas where disease exists, and the placing the treatment of diseased animals in the hands of reliable veterinarians. Accurate diagnosis of disease necessitates not only an efficient Veterinary Department, but also a staff of scientists trained in the investigation in the cause and treatment of animal pests.

Veterinary science owes much to the assistance it has received from agriculture, but it has more than repaid this debt by the enormous benefits which its discoveries have conferred on agriculturists in every part of the globe.

British veterinary science in the beginning of the 19th century was fostered by both the Royal Agricultural Society of England and the Highland Agricultural Society of Scotland. The small annual grants made by these societies greatly helped the teaching of the veterinary science of farm animals. On the Continent, veterinary schools have been fostered by the different Governments in a very liberal manner, and, as a result, agriculture has benefited to a very marked degree. It is only quite recently that the value of the work

being done by private enterprise in Great Britain has been in any way recognised by the Government, and even now the indebtedness of agriculturists to the veterinarian would appear to be only very scantily acknowledged.

In America and the British Colonies the teaching of veterinary science generally still leaves much to be desired, but the demand which has arisen for better trained veterinarians is gradually necessitating better methods in the teaching of veterinary graduates. In 1862 the "Morrill Bill" became law in the United States. This Bill aimed especially at the encouragement of education along the lines of agriculture and the mechanical arts. Agricultural Colleges were organised in the various States, and were supported by liberal annual grants from the National Treasury. At these colleges lectures on veterinary science were given to agricultural students by veterinary surgeons, most of whom were men who had been trained in the British veterinary schools. In this way the true value of veterinary science was placed before stockowners, who began to demand better educated veterinary surgeons, and in consequence, veterinary colleges in connection with agricultural colleges appeared in many of the States. These colleges are supported by funds drawn from National and State appropriations, and have done much towards the advancement of knowledge of stock, both in health and in disease.

In the British Colonies very little has been done to further the teaching of veterinary science owing to the want of State aid and the difficulty in obtaining efficient teachers. The education of a veterinary surgeon necessitates far more than the attendance on a few veterinary lectures at an agricultural college, and it is very doubtful if really efficient veterinary schools will, for many years to come, be founded in any of the Colonies. Far more satisfactory results would be obtained by granting scholarships at the British veterinary colleges to promising Colonial students.

In all new countries where land is sparsely populated, animals run in a semi-wild state, and are, as a rule, of low individual value. Their loss from sickness is often looked upon as inevitable and of comparatively little consequence. It is only when an animal plague appears that the community begins to appreciate its helplessness, and to cast about for means to save its stock. Gradually as countries become more thickly settled, more attention is paid to stock raising, and the improvement of the different breeds of animals. Animals become more valuable. Agriculture is taken up by men trained in scientific schools, and the demand for efficient veterinary surgeons increases. This is what has happened in all our British Colonies, and the full appreciation of veterinary science by stock owners is always only a matter of time. State veterinary science is a true economic science. It saves money and repays an enormous interest on any capital invested in it. This interest is repaid to the agriculturist by ensuring him against the loss of his stock from disease, and teaching him the best methods of breeding and rearing animals.

NOTES ON THE SABI GAME RESERVE.

By Major J. Stevenson Hamilton,
Warden, Government Game Reserves.

THE outcome of the general feeling in the country—a feeling which, by the way, was no new one—that the remnants of the once magnificent fauna of the Transvaal ought to be rescued from the complete extirpation which threatened them, was the establishment, a little over four years ago, of the Government Game Reserves, or, as perhaps they might be more definitely styled, Game Sanctuaries.

In July, 1902, was reincarnated the old Sabi Reserve, originally established in 1898. In the following year, at the request of the principal landowners concerned, the country up to the Oliphant's River, especially valuable from a game protective point of view, as being the home of the few remaining specimens of certain species not found elsewhere in the country, was added. About the same time another reserve was declared between the Letaba and the Limpopo Rivers, an area consisting of entirely unsurveyed and unalloted Government ground, seldom in the past visited by any except hunters and a few prospectors, and by these only during a few months in the year. It had been very considerably, in some places entirely, denuded of game by white hunters as well as by the native population living in, or close to it, but, owing to the fact of adjoining Portuguese territory still holding a not inconsiderable stock of game, the prospects of development appeared encouraging. The reserves are throughout coterminous with the Portuguese boundary on their eastern side, and extend thence westwards for a distance of approximately fifty miles. Needless to say the whole area embraced is what is known as Low, or Bush Veld, rising from an elevation of 400 feet, just underneath the Lebombo Hills, to from 900 to 1,000 feet on the western borders.

Many readers of the *Agricultural Journal* are, no doubt, well acquainted with the general configuration of this country, but, for the benefit of such as may not have visited it, some slight sketch of its general character may not be out of place. In the first place it differs essentially in nearly all its characteristics from the higher bush country of the Eastern Transvaal, *i.e.*, that found at a greater height than, say, 1,200 feet, and under the foothills of the Drakensberg, while varying itself considerably in different localities. Speaking generally, the country included in the reserves may be said to consist of a more or less pronounced series of undulations gradually merging into an almost flat terrain as the Portuguese boundary is approached, the whole permeated by deep cut watercourses, and clothed in a varying but monotonous garment of more or less stunted forest

in which the acacias predominate. Here and there, by the banks of the few perennial streams, or by the numerous dry watercourses, we find a larger growth of timber; but, speaking generally, the task of obtaining long and fairly straight poles of the necessary durability to render them suitable for the requirements of house-building, etc., is a difficult and long one.

In places, the expanse of bush opens out into small clearings, comparatively, or even entirely, bare of trees, while, looking down from any elevation, curious winding avenues, also treeless, may be remarked meandering through the surrounding bush like rivers; the soil in these is often of a black spongy nature in which, after rain, a horse flounders as in a bog, but which quickly cakes into a hard surface and does not seem to be associated with the existence of permanent water. In other places, again, the bush closes to the densest of thickets where the *wacht-en-beetje* and mimosa thorn trees grow so closely that a man may only win his way through with much difficulty and rending of garments.

Features of the country are the outcrops of granite which spring up in the shape of solitary kopjes composed of huge tumbled masses of enormous boulders standing like sentinels on guard at intervals of a few miles and which serve as the homes of colonies of baboons.

Water is very scarce, a few large perennial streams water the country flowing from west to east, being, generally, direct or indirect affluents of the Limpopo. There are, besides, a multitude of water-courses varying from the size of considerable rivers to that of small drains, all only holding water during the rainy season, and then only for a few days after each deluge of rain, and in the larger of which, during the remainder of the year, water is only found with difficulty in stagnant pools or by digging in the sandy beds.

The soil, on the whole, is sandy by nature and shallow, with a tendency to become richer and deeper as the foot of the Drakensberg is approached. Granite rock is elsewhere commonly struck after a very few feet of digging, which may probably account for the stunted nature of the vegetation, for, although grass fires are, no doubt, responsible for much twisting and warping of sapling trees, they only occur in the neighbourhood of native dwellings and public thoroughfares, and are usually owing to the numerous deeply cut watercourses of a comparatively local nature; whilst in the huge tracts of absolutely uninhabited country where no grass has been burned for many years, there is no perceptible difference in the class or size of the trees met with. Indeed, the general incapability of the soil away from the banks of the watercourses to grow large timber has been shown by the attempts to grow gum trees which, although carefully tended, have, except in a very few cases, either shown the same stunted appearance as the local trees or have grown to a good height in four years, but with the roots running along the top of the ground, so that storms will, in a short time, certainly dispose of them.

As far north as the Sabi River the bush is denser in character, and the mimosas more plentiful than between that river and the

Oliphants; in the latter district, too, the solitary kopjes are less numerous, and the country on the whole flatter. About ten miles south of the Oliphants, the Mopani tree is, for the first time, met with, and after the Letaba is passed it predominates over everything else; thence north the Baobab (cream of tartar tree, as it is sometimes called) becomes more and more numerous; it is not found south of the Oliphants River. A very dense bush extends from just south of the latter river, right up along the Portuguese boundary, with just here and there a few breaks, to where the Limpopo marks the northern boundary of the Transvaal; much of this is quite impenetrable, and is seldom if ever entered even by natives.

Summer temperature varies from 95 to 110 degrees Fahr. in the shade; a few degrees more may have been registered on exceptionally warm days, but the latter is the greatest shown at Sabi Bridge in the last four years. The most oppressive weather, however, is that usually experienced about March, towards the end of the rains, when the thermometer perhaps does not indicate more than 90 degrees, but the moisture soaking the atmosphere renders the slightest exertion a labour, and the white man feels tired an hour or two only after getting out of bed.

Malarial fever is prevalent throughout the game reserves; it is at its worst towards the close of the rainy season, but cases, no doubt, do occur at all times, and most of the "old hands" in the Low Country suffer from relapses chiefly during the winter months or healthy season. Natives coming from the High Veld seem to suffer from malaria in a greater degree than do white men, and even local natives are not always immune. Last year, for instance, one of the native police died from blackwater fever, although he had been bred and born and lived in the country all his life. Some few cases occur each year amongst the natives of the district, especially in the eastern parts. So far, none of the white staff of the Game Reserves has been so unlucky as to contract this very serious type of malaria, but one man had it, shortly before joining.

Horse sickness would appear to be present throughout the year, though less noticeably so during the winter; certainly from September to the end of May no unimmune horse has a chance of surviving more than a month or two at the longest estimate. All domestic animals seem peculiarly liable to liver and stomachic complaints, especially from the middle of March to the middle of May. Biliary fever sometimes completely sweeps off the dogs in a district, and, in fact, to have any chance of retaining livestock during the dangerous months, the greatest care in segregating them from outside influences has to be maintained. Even with the utmost vigilance, losses are certain to occur.

Crops are difficult to raise owing to uncertain rainfall and fecundity of insect pests. It is customary for the native crops to fail at least two years out of three. A good year as regards rainfall generally implies swarms of locusts and a plethora of other insect scourges. In the year 1902-3 no grass grew until the end of January.

Irrigation would present considerable difficulties and imply very large outlay, as, owing to the deep channels of the perennial streams, considerably below the level of the surrounding country it is not easy to make use of the natural fall. There are no perennial springs known in the low country, though these are not infrequently to be met with amongst the foot hills.

The native population is few and scattered; in recent years, partly owing to the gradual dessication of the country, and partly owing to the hunting being stopped, many have removed their habitations to the more productive portions of the Low Veld, lying west of the Reserve boundary, and under the hills. Previous to the inauguration of the Reserves these people contented themselves with planting mere patches of grain, and were, in fact, to a great extent independent of what they were themselves able to grow, as they lived on, and by, the game, trading the meat which they did not require, together with skins, in exchange for various foodstuffs either with white men or with natives outside the game districts whose supply of cereals was more plentiful. These now remaining plant more grain, and display greater concern in the care of it than is said to have been formerly the case. Before 1899, the country under discussion was a little-known wilderness, which white men—if the short period of the building of the Selati line is omitted—never entered except during the four healthy months, when hunters came down to lay in their summer store of biltong and supply of skins and horns, while prospectors roamed through it with a commendable persistence only equalled by their want of success. Latterly, the opening of the Netherlands Railway and the building of the Selati Line brought a good many sportsmen and others from the towns in addition to the regular hunters.

During the rest of the year the land was given over to Nature and the Kaffir. Swarms of natives from Portuguese territory would then come in, and, secure from interference, would hunt to their heart's content, returning across the border before the time came round again for the annual visits of the white men. These natives, who led a semi-nomadic life, sowed each season a few crops around their various hunting camps, coming back each year to a different locality as their inclinations and the movements of the game might induce, but always camping close to the waterholes and cutting out all the best timber in order to make way for their mealie and Kaffir corn patches. The game was being rapidly killed out, of course, and the best trees destroyed. This had been going on in an increasing degree for a matter of twenty-five years, or since the cessation of the Swazi raids.

The idea underlying the establishment of the Game Reserves was primarily to effect the rescue from complete destruction of the last of the big game, by providing a surer, more special, and efficient method of protection than was possible in the rest of the country, and under the ordinary game laws. The localities selected were those which the malignancy of the climate and other untempting conditions

during most of the year had, in the past, caused to be studiously avoided by white settlers, and in which, from the same causes, the native population was few, scattered, and, to some extent, nomadic. From these very conditions which rendered it so repugnant to man, the country had proved the last haven of the big game. It was desired first of all to get the latter on a thoroughly good footing within the Reserves, to allow them to breed undisturbed and unhindered, so that the more numerous species might spread, and, after having filled the grazing grounds within the Reserves, gradually overflow into the country round, while the rarer species might have a chance to get upon a sound basis.

At first the game was found to be in a far from satisfactory condition; it was scarce, timid, and constantly on the move, a state of things not conducive to an adequate increase of species. Some kinds of animals were upon the verge of disappearance, and it was possible to cover very large tracts of country, especially in the western portions where the winter hunters had been most active and numerous, without seeing a sign of life, nor even a solitary spoor. The bush in such places seemed "dead." Moreover, the carnivorous animals had not suffered relatively to the game. It may seem surprising, but it is nevertheless the fact, that it was rather the exception than the rule for white hunters to devote any attention whatever to the predatory animals. Wild dogs were not deemed worthy the expense of a round of ammunition; there was evidently no unseemly haste to pursue the lion. Native hunters practically never wantonly interfered with the larger carnivora; it is usual with natives to destroy only such individuals as have made themselves a nuisance by attacking live-stock, a rare occurrence so long as there is game about. Consequently, the little disturbed beasts of prey were found congregated in considerable numbers wherever the game had collected in remote corners in order to be immune from the hunters' rifles—and, no doubt, a larger percentage of game was being killed by them than would have been the case under ordinary conditions. There can be no room for doubt that, in the absence of prompt measures, the great decrease in the natural food of the larger carnivora would have rendered them at no distant date a positive danger to the adjoining and inhabited parts of the Low Country.

The first care was the selection of suitable men for the posts of rangers, which may, perhaps, sound an easy task, but is in reality a matter of some difficulty. A man must be prepared not only to lead a lonely life, and to travel about the country at all seasons and in all weathers, but must cheerfully incur the certainty of ordinary malarial fever and the possibility of blackwater. He must also be thoroughly conversant with native languages, customs, and idiosyncrasies, interested in game and all pertaining to it, an expert bushman, and possessed of some knowledge of police work, and of methods of working native constables. Above all, he must be thoroughly active, reliable and trustworthy. It is clear, therefore, that an efficient ranger must be possessed of qualities not met with in everyone, and

is not the sort of man who would be long out of a job however hard the times. The white staff having been made up, each ranger was allotted a district for the good order of which he was responsible, and having under his immediate orders a small number of native police, who were usually distributed on the picquet system.

At first there was a good deal of native poaching to contend with, which was gradually suppressed so far as Transvaal natives were concerned, but the Portuguese border has still to be carefully watched as most natives there have guns, and it is not a difficult matter to slip backwards and forwards over the border, while after being detected, and if not actually caught, Portuguese territory is sanctuary for the native subjects of that country. Exciting struggles in this frontier region are not uncommon, and one of the native constables was actually killed by poachers last year. Nevertheless, there is no doubt that a wholesome fear of the consequences of hunting in the Transvaal has been established, and that natives from over the border only venture a very short distance inside and hurry back as quickly as possible.

The natives actually resident in the Reserves do little, if any, damage now. Game is found grazing with confidence close up to kraals; the people, in fact, are getting accustomed to the habit of not hunting. The effects of the early steps taken were not long in becoming apparent. The game in a short time became more settled in its habits, finding that it could graze undisturbed. Animals accustomed to seek the shelter of the densest cover from dawn to darkness began to come freely into the open. Water-loving animals, instead of retiring far up the dry ridges during the day, as had been their wont under persecution, were soon found resting under the trees by the river bank. The game began to return to its natural habitat.

At the present time, the really marvellous tameness and confidence in man shown by the majority of the animals, both great and small, is remarked by every observant visitor. It is no unusual thing to pass troops of game standing or lying ruminating in the shade within 100 yards of the path who scarcely take the trouble to get on their feet to stare at the intruder. Wildebeeste, sable, and zebra accompany the traveller here and there, consumed with curiosity as to what manner of things he and his horse may be, dashing furiously past, pulling up with a jerk across the path in front, cutting all sorts of queer capers, and finally standing staring after the traveller till he is out of sight.

It is truly terrible to think of the destruction which a conscienceless reprobate armed with a magazine rifle could effect amongst these confiding creatures. Hence the necessity of strict regulations regarding routes of traffic and the carrying of firearms. I have not infrequently seen duykers and steenbuck who have got up on hearing someone approaching, after a short inspection, calmly lie down again in full view and go on cropping the grass.

It has often been stated, I am bound to say I think in the beginning by self-interested parties, that the preservation of game

encourages the undue increase of vermin, which are likely to become a public danger. I have even seen it stated, rather to my amusement, that the Reserves are nothing but breeding grounds for lions and other predatory animals. Now, it must surely be obvious to anyone who keeps an open mind on the subject, that the increase of game in a district tends not to drive away the carnivora, but to keep them inside, where they are enabled to procure a good supply of their natural food; there can be little inducement to them to wander away outside in order to pick up a precarious livelihood. In fact, the only factor at all likely to urge them to take this course might be the making of things too unpleasant for them inside. Even left to themselves, carnivora never increase out of a due proportion to the game on which they prey, as is sometimes ignorantly stated, always supposing that man does not step in, and by destroying the game, unduly upset the balance of Nature. The latter, indeed, may be trusted to be a tolerably good regulator of such matters, and if she suffered her laws to be so inefficiently drawn up as to allow the purely flesh-eating animals to be equally prolific with the others, surely long before man made his appearance upon the scene at all, the latter would have entirely disappeared, and the former been reduced either to altering their diet or to following the somewhat violent example tendered by the historical cats of Kilkenny. But nothing of the kind did, in fact, occur; our first records of uninhabited districts show them more often than not to have been teeming with animal life of all kinds, and yet, previous to the appearance of man, especially of man equipped with firearms, upon the scene, such creatures as the lion, the leopard, and the hunting dog must have led an existence very nearly ideal. When the game has, by the efforts of man, or through the agency of some epidemic, become unduly reduced, then the carnivora, driven by hunger, do, no doubt, become a very real danger both to the resident and to the traveller, but, given ordinary conditions, they will never, in such a place as a game reserve, assume the preponderating numerical proportions sometimes credited to them.

Moreover, the reduction of carnivorous animals to, and their retention within, proper and moderate limits when carried out on methodical principles, ought not to, and does not, present any insuperable difficulties, so that, far from increasing, they ought to decrease in numbers considerably, while the game, upon the other hand, multiplies unhindered. With the decrease in numbers of predatory animals comes a corresponding decrease in competition, which cannot act otherwise than as an incentive to retain them in their accustomed haunts. Indeed, judging from the returns of carnivora killed in the neighbouring districts, and comparing them with those of the Government Game Reserves for the same period, one is forced to the conclusion that so far from the various beasts of prey having spread into the surrounding country, they have almost entirely left the latter and gone down into the game reserves. For, in one district, there is only a return of nine predatory animals shown as killed, and in another none at all!

Personally, I am convinced that predatory animals in a wild state tend to increase very slowly. The argument is sometimes used that because the canidæ and the felidæ give birth to several young ones at a time they must, therefore, increase if not kept down at a greater rate than any given species of herbivorous animal, which, as a rule, produces only one offspring per annum. Especially would seem the rate of production of the African Hunting Dog (*Lycaon pictus*) to be often exaggerated; owing to the fact that as many as a dozen young ones are sometimes found collected in one nursery, some observers have jumped to the conclusion that they must be the offspring of one mother. Females killed, however, have, in my experience, never been found to contain more than three or four, and the congregation of a large number in one place more probably points, it would seem, to their being the offspring of several mothers. It is, moreover, exceptional to see more than two or three young animals in a pack of, say, a dozen individuals, which would not be the case were the litters as large as popular conception would have them. Lionesses, again, have generally three cubs at a birth, but it is generally agreed that seldom more than one or two of these see maturity. Owing to the relatively short period of gestation of these animals, and the consequently early period at which the cubs are weaned, it might be inferred that, in a wild state, they would breed annually, as in captivity; but here the influence of environment makes itself felt: before the mother can undertake the care of a new family the juveniles must be taught to be independent, to hunt and kill animals larger than themselves without assistance, and this process of instruction, no doubt, eats into some considerable period of time. A lion cub of a year old is still a comparatively helpless animal, his large canines are only just beginning to obtrude their points, and the milk teeth which he still uses are weak and fragile things. At that age, though as big and heavy as the biggest dog, he still has a long time to go before he becomes capable of taking the field himself, free from maternal guidance.

The care and trouble taken by a lioness and her mate in teaching their young family to kill game neatly is well known, as well as the amateur results of the latters' first attempts in that direction. This is a question of considerable interest, and one which gives rise to a great deal of discussion, many persons of experience in the hunting veld stoutly maintaining that the increase is at a rate which, when the question is considered, would, if correct, have the effect of setting Nature's arrangements at defiance. Although, owing to his secretive tendencies, opportunities of observing the habits of the leopard are less frequent than in the case of the lion, there can be little doubt, or, at any rate, circumstances point to his increasing in a very similar ratio to the latter. The number of cubs at a birth is similar, and I have twice seen young cubs early in September.

The hunting leopard or cheetah is somewhat scarce with us and generally restricted to the less thickly bushed districts. I think that it is exceptional for this animal to attack anything larger than an impala

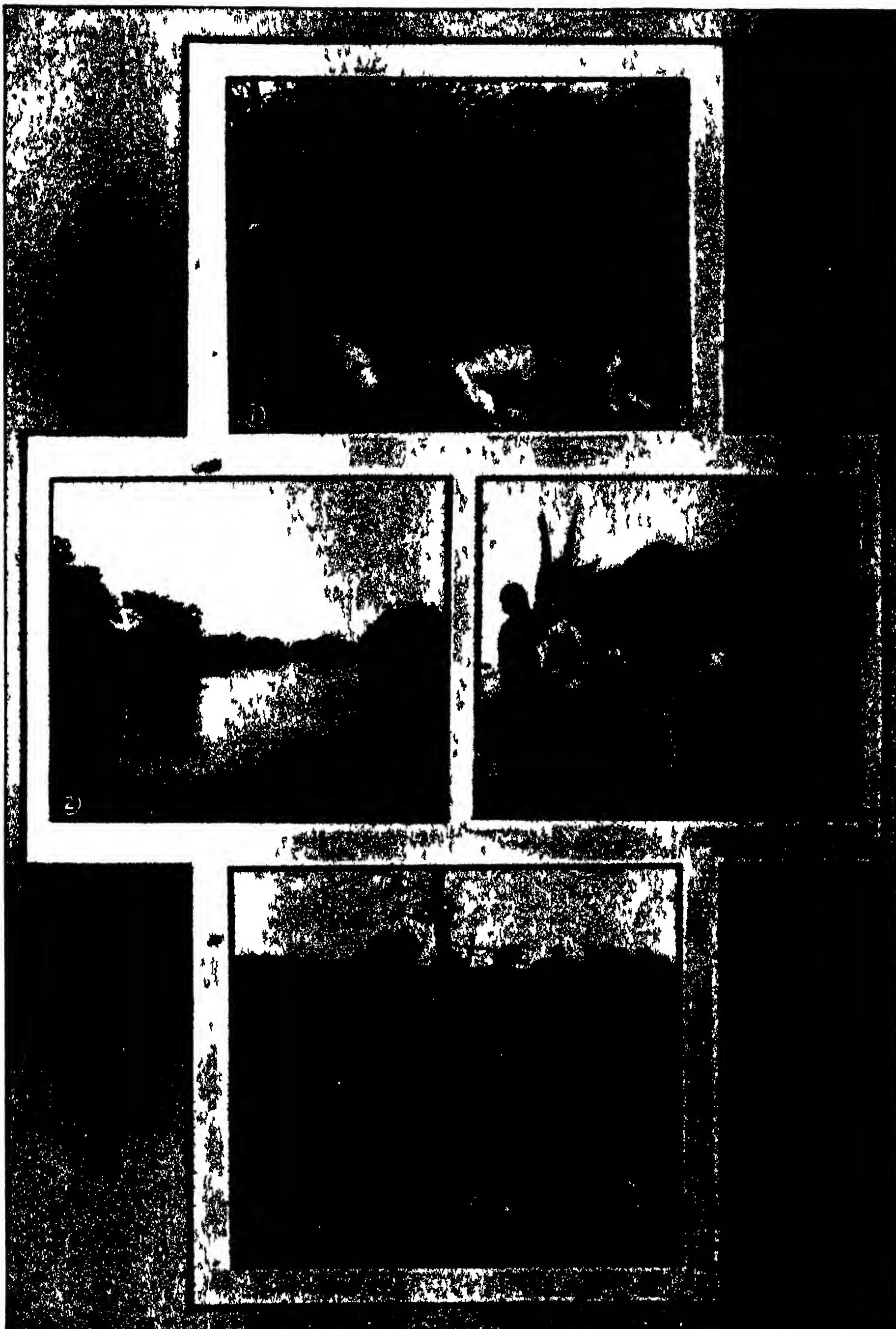

Plate CLXXXI

Views on the Sabi Government Game Reserve.

or reedbuck. Of smaller carnivora, the caracal or South African lynx (rooikat) is certainly the most formidable and destructive; besides game birds, he preys on all the smaller buck and the young of some of the larger animals. The serval or tiger bush cat is a less powerful animal than the last-mentioned, and finds his principal victims among the birds, but young duykers, young steenbucks, etc., also come to his net. The Kaffir cat (*Felis caffra*) is the last of the true cats found in the Reserves, and is most destructive, as is well known, to all birds, including poultry. The large family of the Viverridæ is well represented, the genets, of which there are two species found, being the most numerous and destructive of the larger kinds; they play havoc with the guinea fowl and francolin, and are frequent visitors to the poultry yard. Genets appear to have three young ones at a birth. The small spotted genet is generally found in hollow trees in the bush, generally in rather dry places. The rusty spotted genet, on the other hand, seems to affect the vicinity of the rivers. The civet cat is remarkably numerous, especially south of the Sabi, sometimes attaining to a very respectable size. This animal is often given a very bad character, but I am nevertheless inclined to believe that he is, to some extent, maligned, and that such mischief as he may perpetrate is a good way behind that performed by the Felidæ and most of the larger Viverridæ. Examination of droppings tend to show that his food consists largely of the scaly earth worms which come on top of the ground after rain, of the berries of the thorn tree known to the natives as "Mpafa," sometimes of rats and mice. He is also not averse to carrion and can be caught in a trap baited with a bit of meat or a dead bird. Although practically every other description of predatory night prowler has been caught at one time or another in the vicinity of the fowl roosts, I cannot call to mind a civet cat in such a situation. That is my personal experience, though it is said that he will kill poultry sometimes.

Most of the Mungooses, of which, with us, H. Caffer (large grey mungoose), H. Albicauda (white tailed mungoose), and H. Galera (water mungoose) are the largest, prey upon rats, mice, birds, sometimes reptiles and insects. The little Wahlberg's mungoose (*Helogale Parvula*) is really a public benefactor, as the examination of the contents of a good many stomachs has shown scorpions and centipedes to be a favourite food; ants, beetles, and other insects are also, no doubt, caught; it is said that snakes are frequently attacked by these little animals. Probably most of the smaller cats and viverridæ will do this on occasion.

Amongst birds of prey, the magnificent martial hawk eagle is perhaps quite the most destructive to small game, but several of the other larger species of Accipitres run him close. A bateleur eagle (which is, however, not a true eagle) was kept for a considerable time in captivity, became very tame, and was tested in various ways as regards food. Small birds of various kinds were kept in his cage, and he never made any attempt to interfere with them, nor did they betray the smallest apprehension of him. On the occasions of one

or other of these small birds dying, however, the bateleur, as soon as he was sure that they were really defunct, greedily devoured them. The same thing was noticed when dead rats or mice were inserted ; he invariably waited a good time watching for any movement, and when they continued to lie still he would hop down and assimilate them; the bateleur is, moreover, generally to be seen in the neighbourhood of a "kill," and I am inclined to think that he subsists on very little besides carrion and reptiles, and perhaps eggs if he can find the latter in the bush. The buzzards are, I think, generally speaking, quite harmless. The yellow billed kite is one of those unfortunate creatures labelled with a name sufficient to condemn him anywhere, "kuiken-dief." What can be expected of a bird with a name like that! I suppose those frequenting the neighbourhood of the Sabi are particularly well behaved either by nature or because they have a wholesome fear of the Regulations; however that may be, there is a very considerable collection of poultry at my station who run about freely everywhere. The yellow billed kite arrives in considerable numbers every year at the beginning of the summer, and, throughout that season, seldom less than four or five are hovering about at one time over the yard during the whole day, swooping down to pick up bits of offal and any scraps thrown out of the kitchen. During four years I have never known a single chick to be harmed by these birds. Eagles and hawks of many kinds have, from time to time, taken toll, but I must give the yellow billed kite, so far, a clean sheet. For a considerable time I admit sharing the general belief, and invariably shot them whenever seen, but, after a time, seeing that it was not possible to get rid of them owing to their number, and that no chicks seemed to be taken, I gradually desisted, and now they come and go as they like. No doubt a bird having once done evil, might be tempted to make a practice of it, but, in their unsophisticated state, I do not believe that these birds prey on live mammals at all. They are great carrion eaters, and seem as quick as the vultures themselves at picking up the sight of a dead animal.

All species of game within the Reserves have increased and done very well in the last four years. Of course several decades of ruthless destruction cannot have their effects nullified in so short a time, and many rarer kinds of animals are still extremely scarce. It is a short affair to slay a creature such as a giraffe, for instance, but, at the rate of one young one in three years or so the increase is a slow and tedious matter, and the process of reconstruction takes time. The same refers to the elephant, the rhinoceros, and the hippopotamus. Elephants have very tentatively begun to make their appearance in some of their old haunts, but are evidently as yet by no means sure of their welcome. Fortunately, there are still a considerable number in the thick bush over the Portuguese border. The larger antelopes breed regularly once a year, and have one young one at a time. At that season it is necessary to be especially on the alert, as all kinds of predatory animals, as well as natives with their dogs, are alive to their chances. The eland was, unfortunately, exterminated in the

Transvaal, but we have recently imported some young ones from Portuguese East Africa in the hope of being able to domesticate them in the country. There really seems very little reason why the eland should not fulfil most or all of the functions of cattle, while being immune to many of the plagues which affect the latter. He is exceedingly docile, gentle, and intelligent, and his size, strength and weight are equal to anything required.

Ostriches have done particularly well, and are now quite numerous in their favourite localities.

The existence of such institutions as game reserves would seem to be necessary in a country like the Transvaal where the great body of public opinion is intensely anxious to preserve the fauna, but where the presence of a minority of white men who are reckless or lacking in foresight, and of a large native hunting population who practically would, under ordinary circumstances, have the big game districts to themselves for eight months of the year, would soon cause the game to cease to exist. The impossibility of effectively enforcing the Game Laws outside the Reserves is conclusively proved by the numerous reports and complaints of game destruction which have latterly been coming to hand from all of the less frequented parts of the country in ever increasing numbers. In the north and north-west we hear of waggons loaded up with biltong, chiefly representing royal game, of hunters' camps everywhere, and general disregard of any of the interests of the game. In the east, again, there has been serious destruction, so much so that sportsmen are asking that something may be done to put a stop to the reckless waste and pointing out that, at the present rate, a few years will see all the game vanished. In these last districts, there seems little reason to doubt, at least so far as the Low Veld is concerned, that it is only the "feeding" from the neighbouring game reserve that has allowed of many animals having continued to exist even up to the present.

Under conditions at present obtaining, it is clear that the maintenance of such sanctuaries alone gives guarantee for the continued existence of the magnificent Transvaal wild fauna. As is the case with domestic animals, a certain extent of land can support a given number of animals only, and as few, if any, of the herbivora are omnivorous as regards the vegetable creation—each species having its own particular and favourite grass, plant or leaf—when the particular food becomes too scarce in any given spot to support the number of animals present, the surplus must of necessity wander further afield in order to seek means of support. Thus, when by strict protection, the Game Reserves have become well stocked, there will be a considerable annual overflow into the surrounding country, which will spread in a greater or less degree afield relatively to sane methods of shooting being observed or the reverse. But, no matter how the game is shot down outside, so long as the Reserves continue, this overflow will always be maintained, and there will be sport to be had, though manifestly less than would be the case were the game outside not destroyed to such an extent as to obviate the local increase

and spreading which the sparing of females and a rational system of hunting would induce. And here is, perhaps, the crux of the whole matter—*the sparing of females.*

If only the importance of this could, by any possibility, be borne in upon everyone, then there would be but little necessity for game reserves, for making certain game "royal" or for many of the other at present unavoidable restrictions. It should be remembered that the killing of every female means not the destruction of one animal only, but, potentially, of many. As a rule, the true sportsman would seldom desire to bring one down, but there are, unfortunately, many—in addition to the mere hunters for purposes of gain—who measure their success by the number of their "bag," and who, in trying to attain to a large total, are quite oblivious of either age or sex. The custom of pumping lead out of a magazine small bore rifle promiscuously into a troop of game or after single running animals at such distances as preclude accurate shooting cannot be too deeply deplored. For one animal picked up under this method probably four or five get away more or less maimed and injured to die in agony, or crippled, to fall victims to the first prowling beast of prey encountered. Very possibly, many of those following this system see no harm in it, and consider it to be a most admirable method of procedure, but, emphatically, it is not sport, and the sportsmen of the country would do well, in the present depleted state of the game, to endeavour to inculcate by every means in their power a more rational appreciation of the joys of the chase and a deeper consideration for that fauna which Nature has lavishly provided indeed, but which is very far from being inexhaustible. The sportsman, as differentiated from the mere "shootist," finds a multitude of joys in the selection of his specimens, and the studying of the habits of the game which are quite unknown to the other. Hunting in the old days was a very different matter; the hunters were dependent upon the game for their existence, they knew their work, ammunition had to be husbanded, while the game was present in such enormous numbers that it is not surprising that it seemed inexhaustible. The large bullets used, as well as the accuracy of the hunter's aim—it being important not to waste a shot—generally accounted for most animals hit. Viewed from a sporting standpoint, it must have been glorious to ride over the boundless veld at a stretching gallop in the rear of a troop of great game, feeling that every shot from the slow loading weapon carried must be made to tell ; for success the hunter was dependent upon his own craft and skill. But these days are past, and it is not emulating the prowess of bye-gone Nimrods, this pouring of a stream of small bore bullets, which to be deadly, must be very accurately directed into a terror-stricken herd of flying buck, with subsequent more or less casual picking up of the fallen. In these days of repeating rifles, when ammunition is to all intents and purposes unlimited, when there is no question of necessity, and when game, moreover, is in many parts on the verge of extermination, other methods must be used if we are to avoid that

contempt of future generations which we should thoroughly deserve did we deliberately eradicate and wipe off the face of the earth the many species of beautiful and harmless animals with which the country has been so liberally endowed. The game, though in sadly attenuated numbers, is still with us, but throw open the sanctuaries, and some three or four years at most would see the very last of anything larger than a duyker throughout the Low Country, for with the disappearance of the sources of replenishment, the animals would quickly disappear, and the Bush Country would become nothing but a deserted, lifeless, fever-stricken wilderness, shunned by man and abandoned by its natural denizens. Once the game is gone we can never get it back.

The population of the country is very different, numerically and otherwise, from that which pursued the wild game over the limitless plains in the old days. For one man armed with a muzzle loader, we have now fifty equipped with magazine rifles. "*Tempora mutantur, et nos mutamur in illis.*"

There is no doubt but that the tsetse fly formerly was responsible for the saving from destruction of a good deal of game, as it kept hunters from going otherwise than on foot into the "belts." However, the fly disappeared after the rinderpest, not as is sometimes loosely averred because the game was finished, because we know that it was not—even a certain number of the buffalo surviving—but from the much more probable reason that it itself died from the effects of sucking the blood of the diseased animals. Since that time it has been unknown in the Transvaal, nor does it seem probable, seeing that it is equally absent from Portuguese territory adjoining, and from contiguous portions of Rhodesia that there is much likelihood of its early return.

There can be no doubt that game preservation in general meets with hearty support from practically all who have a stake in the country. The majority of farmers are not blind to the advantages of having a good head of game on their farms; it represents a considerable asset. But in this matter it is well to think broadly; in order to benefit the private owner game should be well preserved throughout, on Crown land as well as on private land; we want to see it well spread over the country, returning perhaps to haunts from which it has been long absent. Some of the animals now found in the Bush Country of the Game Reserves are really indigenous to the Middle or even High Veld, from which they have been forced gradually by persecution. Notable amongst these is the roan antelope, who habitually favours open country, but here is often found in comparatively dense bush. No doubt such animals, if left alone, would surely, if slowly, tend to wander back. There is no doubt that it will be possible to supply farmers artificially with certain kinds of buck in the future when the Reserves have themselves become well stocked, and except to those who look on the fauna of a country merely as so much cheap meat and leather to be exploited for purposes of personal gain as quickly as possible, and without regard to those who come after, such institutions should be popular as forming the

nucleus or nursery in which the game increases undisturbed, and from which it can spread naturally, or be brought artificially to all parts of the country.

The people of this country should not shut their eyes to the fact that on the action of the white man alone depends the annihilation within a short time of the game or its continuance and increase. It is easy, and a comfortable way of shirking responsibility to say, as is often done, that the Kaffirs are killing all the game. This is simply nonsense, though I am far from saying that the native would not do his best had he the means and opportunity, but, deprived to a great extent of firearms as he is, and unable to organise the big drives of game by means of which, previous to the advent of the white man, most of the slaughter was done, he can never exterminate nor even greatly reduce the game. The only places where game could, and would be, exterminated by natives are the present game reserves bordering on Portuguese territory in which latter nearly every native has a gun, and are fast extirpating all the game on that side of the border. It should be remembered that even in these past days the utmost efforts of natives and of beasts of prey had nowhere in Africa effected any appreciable reduction in the number of animals. Of course in the present depleted state of the game, natives can do, and, indeed, are, responsible for a good deal of damage by means of dogs, gins, snares, and small local drives of kloofs, reedbeds, etc., and, without doubt, guns are here and there hidden away and let off on the quiet, so that continued vigilance is required. But while the natives in general are not possessed of firearms, and, moreover, receive some supervision, one shooting party of white men will probably kill more buck in a week than all the natives of that district put together will account for in a year.

Probably it is not above the mark to say that even when we allow for damage done by native poachers from over the various borders, white men kill a hundred buck for every one killed by Kaffirs, and, moreover, the victims of the native dogs and snares are generally such animals as duykers and steenbucks, which will probably be the last two species to vanish from the country, while the white man's range is only limited by his shooting licence, and not always, alas, by that.

I merely emphasise these points, not from any feeling of admiration of the Kaffir in regard to his relations to and feelings for game, but to try to point out how important it is that sportsmen should realise the immense importance of arousing public feeling and awakening sentiments of true sport, so that the force of public opinion will become so far reaching and effective that it will no longer be considered "smart" to evade the game laws which are, after all, framed entirely for the public benefit, and no longer a matter for boasting, but rather one for studious concealment and remorse that a huge bag has been made and numbers of females and undeveloped animals ruthlessly and wantonly slaughtered. The days of shooting in order to make money out of the sale of horns, hides, and biltong are, or should be, things of the past. The era when that state of

things was desirable has passed with the multitudes of wild animals which once covered the land. It was all very well in a wild, half, or wholly unexplored country as this once was, but now with almost every part of the Transvaal attainable by railway, and with a large population all anxious to have each man his chance at the vanishing game before it is all gone, it is necessary if we want to save any part of the latter, to adapt ourselves to the example of other civilised countries.

The United States is a case in point. They had let things get to an even worse pitch than we have here, when suddenly the public conscience awoke, and it was discovered that if anything was to be done it must be done quickly, and money must be spent freely. Hence the celebrated Yellowstone Park and the less well-known Reserve in Wyoming which is, or was, guarded by a military post and patrolled by a troop of United States cavalry in addition to the ordinary game wardens, while the most rigorous methods are, or were, in force. Our condition as regards game is, doubtless, not so bad as theirs, nor is our population so lawless as to demand such draconian methods; all that is required is just a little better realisation of what is going on. Some of the railway records of meat sent by train alone would probably startle a good many people were they to be made public. As years go on there seems every likelihood of the shooters increasing in inverse ratio to the game, so before it is too late it is to be hoped that that public feeling which can alone be of lasting effect may be aroused and that a happier era may dawn.

THE RISE AND GROWTH OF THE TRANSVAAL AGRICULTURAL UNION.

By F. T. Nicholson, Secretary to the Union.

AT the request of the Editor, I have undertaken to give to the readers of the "Journal" an account of the establishment and work of the Transvaal Agricultural Union. The sketch must necessarily prove very imperfect owing to the exigencies of space. At the same time I hope to be able to lay some of the main features of the movement before those who may take an interest in the subject.

In the year 1896, at a Committee meeting of the Pretoria Agricultural Society, a suggestion was made that the interests of Transvaal agriculture might be considerably furthered by the formation of a Union which would serve to link together the scattered forces of the various Societies which were then in existence in the Transvaal. The idea found support among the members of that Committee, and, in August, 1897, it was decided to instruct the Secretary to endeavour to arrange for the holding of a meeting in Pretoria to consist of delegates from such existing Societies as might be disposed to assist the project. As a consequence, a circular was drawn up and forwarded to the Secretaries of these Societies asking them to call a meeting of their members for the purpose of discussing the proposal, and, if agreeable to the establishment of such a Union, they were asked to send two delegates to a meeting to be held during the month of September. Favourable replies were received from seven Societies, and a meeting was fixed to be held in the Masonic Hall, St. Andries Street, on the 29th September, "for the purpose of considering the desirability of establishing a Transvaal Agricultural Union." That meeting was attended by fourteen delegates, including the Secretary of the Pretoria Agricultural Society. The following Societies were represented by the gentlemen whose names are given below:—

Pretoria.—J. J. Enschede, R. T. N. James, F. T. Nicholson.
Klerksdorp.—H. Bramley, A. Chittenden.
Barberton (De Kaap).—Geo. Redpath.
Vryheid.—A. von Lefetzow.
Johannesburg.—H. J. A. Wentworth.
Middelburg.—J. J. Trichardt, B. G. Richter.
Lydenburg.—J. Z. de Villiers, J. P. Coetzer.

Mr. J. J. Enschede was unanimously elected as Chairman of the meeting, and Mr. F. T. Nicholson as Secretary. The Chairman

welcomed the delegates and explained the steps which had led to the calling of the meeting. He pointed out that, owing to the condition of the farming industry in the Transvaal, it had been deemed desirable to endeavour to establish a system of co-operation among agriculturists which it was hoped would eventually result in permanent benefit to the community at large. It was only by means of such a combination that the farmers could hope to make their influence felt in securing such objects as were necessary to place agriculture upon a sound and satisfactory basis. The Union, he believed, would serve as a medium for the expression of agricultural opinion in the councils of the nation, and should eventually lead to the formation of an Agricultural Department in connection with the Government. After some discussion, the following resolutions were unanimously carried:—

"This meeting of delegates from various Agricultural Societies in the Transvaal recognises the desirability of establishing an Agricultural Union in this State."

The rules of the Cape Agricultural Union were discussed, and, with a few amendments and additions calculated to meet local requirements, were adopted. It was agreed that both the Dutch and the English languages should be permissible, and that the Union should recognise no political or race differences. The Central Office was established in the Capital, and the yearly subscription from each affiliated Society was fixed at ten guineas. The delegates present were formed into a working committee, and it was decided to call another meeting in the Caledonian Hall which had been placed at the disposal of the Union, free of charge, by the owner, Mr. J. K. Pape, on the 15th of November, 1897. Mr. Nicholson was appointed as Secretary and Treasurer, an office which he has continued to hold up to the present time.

At the November meeting, which should be regarded as the first regular meeting of the Union after its inception, Mr. J. Z. de Villiers was elected as President. In the meantime the Ermelo Society had joined the movement and had also sent a delegate to the meeting. The rules of the Union having been discussed and finally approved, the meeting adjourned for the formal opening in the afternoon. President Kruger had been invited to open the Conference, but, owing to the fact that the Volksraad was about to conclude its sitting at 3 o'clock that afternoon, a letter of apology was read expressing His Honour's regret at being unable to be present and wishing the movement every success. Commandant General Joubert, Mr. S. W. Burger (Vice-President of the Republic), and Mr. P. J. Cronje, as representing the Executive Council, were in attendance, together with several members of the Volksraad, and a number of the general public.

A most valuable paper was read by Dr. Gunning, the subject of which was "Where are we, and what is Our Goal?" He pointed out that the Transvaal was attracting people from all parts of the world, and that vast sums of money were being invested in the country. Under these changed conditions, it was urgently necessary that we

should take stock of our actual position, and devise means whereby the needs of the future would be supplied. In matters agricultural, the country, with all its vast undeveloped possibilities, was in a most backward state, and but little was being done to supply the demand which existed for the produce of the soil. Importation from abroad was relied upon to meet the immediate needs of the population, and this condition of affairs must be brought to an end. To fit the farmer to play his proper part in the development of the country we had need of organisation, education, energy and unfaltering determination. An Agricultural Department which would investigate the actual position, collect and codify useful statistics, establish educational institutions, grapple with stock diseases, and generally strive to promote the agricultural interests of the country was an absolute necessity. Such a Department would set to work to improve the breeds of cattle, sheep and horses already existing in the land, would introduce new varieties of seeds and machinery, would afforest the country, and would, at all times, be in a position to give the most up-to-date advice to the progressive section of the farming community. In the bringing about of these much-to-be-desired reforms he was confident that the newly-established Agricultural Union would play an important part.

General Joubert, as representing the Government, addressed the meeting and congratulated the delegates on the formation of the Union, which he felt sure would become a power for good in the land. He also thanked Dr. Gunning for his able and interesting paper, and gave the assurance that he would do all in his power to further the objects of the Union. Messrs. Burger and Cronje also spoke, and expressed their sympathy with the movement, and hoped that the programme which had been sketched by the Chairman and Dr. Gunning would become an accomplished fact, and that the agriculture of the country would develop on the lines suggested. Mr. Burger, as Vice-President of the Republic, wished to say that the efforts being made by the Union would have the hearty and undivided support of the Government, and that they were all convinced that the time had come when special efforts should be put forth in order to advance the interests of agriculture in the State.

At this meeting the Secretary was instructed to collect samples of Transvaal produce to be forwarded to the forthcoming Paris Exhibition. This instruction was carried out, and the specimens forwarded attracted the greatest attention, and several prizes were awarded by the judges in the different sections. A deputation was also appointed to visit the Government in order to urge the necessity of setting aside portions of suitable land to be used as experimental stations and nurseries for forest trees, to be distributed throughout the country. A further resolution instructed the Secretary and Dr. Gunning to take steps in order to secure assistance from the Government in respect of a system of irrigation. The same sub-committee was also asked to approach the Government with a view to securing

a grant of £500 to assist in defraying the expenses for the coming year. Upon the deputation visiting the Government the amount asked for was placed at the disposal of the Union. Upon the Secretary devolved the duty of soliciting subscriptions from those interested in agriculture for the upkeep of the Union. This appeal was liberally responded to, and the public have, throughout, shown great interest in the work which has been attempted.

The second meeting was held in Potchefstroom on February 25th, 1898, and was attended by twelve delegates. All the gentlemen who were then delegated to attend the conference are still active members of the Union. The meeting was to have been opened by Mr. P. J. Cronje, as representing the Executive Council, but, owing to serious illness, he was prevented from being present. The President of the Union, Mr. de Villiers, welcomed the delegates and expressed the hope that the coming together of a body of men so widely separated by distance would result in much benefit to agriculture. The annual report dealt with the grant given by the Government to Agricultural Societies, the cultivation of coffee, the publication of an agricultural paper, special terms granted by the railway authorities in connection with shows and with the finances of the Union, a balance of £34 17s. 9d. being shown to the credit of the year. Papers were read on the "Need of an Agricultural Department," "The Prospects of Coffee Cultivation in the Transvaal," "Manures and Manuring," "Irrigation," and "The Cultivation of Rye." A series of resolutions were carried dealing with an Agricultural Department, the introduction of Swiss goats, the establishment of a Dairy Company, and the framing of Regulations for the proposed Agricultural Department.

General Louis Botha, one of the delegates, was entrusted with the task of piloting the measure dealing with the Department through the Volksraad. A further resolution was carried urging upon the Government the desirability of entrusting the Agricultural Union with the distribution of the yearly grant to shows among the various Agricultural Societies, and, upon the case being duly represented to the Government, the suggestion was put into force. Lengthy discussion ensued in respect of the supply of labourers for agricultural purposes, and several important suggestions were forwarded to the Government for their consideration. A memorandum was forwarded to the Executive Council in respect of the granting of title to permanent show grounds for the various Agricultural Societies, and this was favourably dealt with. The necessity for the reduction of railway rates for Transvaal produce was strongly urged upon the authorities. An interesting report was given by the delegates to the Cape Agricultural Union meeting which had been held in Port Elizabeth, and Dr. Gunning gave a *resumé* of the results of a visit which he had paid to a laboratory of Dr. Eddington in the Cape Colony. A memorial was forwarded to the Government urging the construction of the railway line from Pretoria to Rustenburg on the

northern side of the Magaliesberg. A further memorial was addressed to the Government asking for the compulsory analysis of all artificial manures and seeds, so as to prevent the farmer from being imposed upon by fraudulent dealers selling adulterated and impure articles. The need for the passing of such an act is greater to-day than it has ever been in the past, for South Africa is being made the dumping ground for worthless articles which cannot be sold elsewhere.

The third conference of the Union was held in Johannesburg on the 6th of May, 1899, when eleven Societies were represented by delegates. The income for the year had amounted to £1,231, and the Treasurer reported a credit balance of £620 2s. 1d. The report stated that delegates from the Union had attended meetings during the year at Maritzburg, Grahamstown, Potchefstroom, Klerksdorp, Vryheid and Johannesburg. Here we see the germ of a movement which has resulted in the formation of the Inter-Colonial Agricultural Union of South Africa. A memorial which had been forwarded to the Government, asking for a concession for the working of steam ploughs in the Republic, was referred to the Union for its opinion. Needless to say the suggestion was disapproved of, and the request refused by the Government. The question of providing for the increasing numbers of "poor whites" was considered and the Government interviewed on the subject. An assurance was given that additional suitable land would be purchased, and that a scheme would be formulated for placing such needy persons thereon. A most interesting letter from the De Kaap Agricultural Society was read describing the methods which had been adopted in the Barberton District for the destruction of locusts. It was stated that no less than 71 swarms of locusts has been destroyed in sixteen days by means of a mixture of treacle and arsenic. A draft law for the establishment of an Agricultural Department having been duly published, a sub-committee was appointed to carry out the work of revision and to report thereon to the Government. The Government was asked to contribute a sum of £1,000 for the purpose of publishing an agricultural journal, and the proposal was accepted with favour. An invitation to the races being held that day was declined, as the Conference deemed its work to be of greater importance than would be implied in breaking off from its duties to attend a race meeting. A resolution was passed urging upon the Government the necessity of importing stud animals to be placed at suitable centres with a view to improving the stock of the country. It was also announced that arrangements had been made by which the Government had agreed to bear the cost of analysing soils sent to the secretary, by farmers, for that purpose. The Railway authorities were petitioned to grant the returning of empties, free of charge, to reduce the freight on artificial manures and on Transvaal produce. Valuable papers were read on "the Cultivation of Rice" and on "Bee-keeping." The question of the more equitable leasing of Government Lands to tenants was also discussed, and a memorial thereon forwarded to the Executive Council. During the meeting it was announced that the secretary had received

a letter from the Government granting a subsidy of £1,000 per annum for an agricultural paper and promising to have the printing performed at the State Printing Works. A Model Prize List was drawn up so as to form the basis of a uniform system of exhibiting on shows throughout the country. The secretary reported that, during the year, he had succeeded in getting together a small library of about 100 volumes which he hoped would be found useful in connection with the work of the Union. Unfortunately, the greater portion of these books were removed from the office of the Union during the progress of the recent war.

It was decided that the next Conference of the Union should be held at Vryheid, but the war followed; the southern portion of the Transvaal was ceded to Natal, and the proposed meeting has never been held. The work of the Union was carried on up to the breaking out of hostilities, and was resumed on the conclusion of peace and the return of its members to their homes. It will be seen from the foregoing account that the foundations of a successful organisation had been laid during the three years of the Union's existence. The result of the labour then accomplished will be seen in the account which follows.

The first meeting of the Union after the close of the war was held in Pretoria on the 3rd of September, 1903. Some thirteen delegates were present and the Agricultural Department was represented by six of its officials. The chair was occupied by Mr. J. Z. de Villiers, who, in welcoming the delegates after the long period during which no meeting could be held, urged them to face the new conditions with a broader outlook and with a desire to place the agriculture of the future upon a better footing than it had occupied in the past. He particularly welcomed the Director of Agriculture and expressed the hope that the officials of his Department would always work in harmonious co-operation with the Union. He further stated that, during the war period, the secretary had busied himself in preparing reports upon matters of interest to farmers, based upon data which had been collected by him before the outbreak of the war in 1899. Among other subjects papers had been prepared on general farming, fruit culture, cattle farming, coffee cultivation, tobacco growing, horse breeding, cereals and root crops, and drawbacks to farming. These papers would be laid upon the table for discussion. The meeting also dealt with the financial position of the affiliated Agricultural Societies, and a resolution was carried urging upon the Government the necessity of relieving those societies which had suffered damage, by means of a special grant. This suggestion has since been carried out in every case. It was decided to endeavour to compile a list of judges qualified to deal with the various classes proposed on the "Model Prize List." Dr. Gunning submitted a scheme for the reorganisation of the Union so as to make it a more effective medium of communication between the farmers and the

Government, and suggested that agricultural education of a rudimentary character should be introduced into the curriculum of all the country schools. He further proposed to change the name to that of the "Transvaal Chamber of Agriculture." The scheme was discussed and approved of, with the exception of that section dealing with the change of name.

Dr. Jameson addressed the Conference, and promised his assistance in developing the work of the Union. He would gladly avail himself of the valuable experience of the farmers who acted as delegates from their several societies. He expressed the hope that the Union would continue to be conducted on non-party political lines. The chairman stated that the following of this course had resulted in the success of the Union, and there was no intention of departing therefrom.

The Director of Agriculture said that he greatly appreciated the privilege of being present at the Conference. He said that he had read their reports with great interest, and that he had very largely based the present Department of Agriculture upon the recommendation and views expressed in the Union reports, so that they might look upon the Department as the outcome of the efforts of the Union in the past. He hoped that the most cordial relationship would always exist between the Union, as representing the farmers, and the Department of which he had the honour of being Director.

At this meeting the question of the establishment of a South African Stud Book Association was discussed, and a Committee was appointed to meet gentlemen from other Colonies in a Conference to be held at Bloemfontein on December 15th, 1903. A resolution was also passed in respect to the advisability of providing suitable drills for boring for water, so as to enable individual farmers to secure such a supply as they needed, and the secretary was instructed to bring the matter to the notice of the Government. A further suggestion was also made to the effect that the Government be urged to appoint a commission to take evidence in respect of the possibilities of conserving the abundant supply of storm water yearly running to waste. Such a commission has since been appointed, and much valuable information has been gathered.

In July, 1904, a Conference was held in Pretoria, at which some forty-five delegates from various parts of the Transvaal were present. It had been arranged to invite delegates from the sister Colonies, with the view to discussing the advisability of establishing an Inter-Colonial Agricultural Union, and representatives were present from the Cape, Natal and the Orange River Colony. Questions of inter-colonial interest were first discussed by the meeting, and afterwards a set of rules was approved and a provisional committee appointed in order to arrange for the first regular meeting of the newly-formed Inter-Colonial Union in Maritzburg during the following year. This Conference dealt with such important subjects as the establishment of a Stud Book for

pure bred stock in South Africa; the desirability of a uniformly stringent Scab Act for all British South African Colonies; the eradication of East Coast fever among cattle, the reduction of railway rates; the enacting of a law, in each Colony, preventing the introduction thereto of diseased plants and seeds; the damage caused by grass burning; the advantages of co-operation among farmers, and the urgent necessity of taking steps to prevent the Colonies from being injured by the establishment of a meat monopoly throughout South Africa. The Conference was opened in the Legislative Council Chamber by the Lieutenant-Governor, Sir Arthur Lawley, and the delegates were entertained at a luncheon given by the Mayor and Town Council of Pretoria.

At the close of the inter-colonial business, the Transvaal delegates continued their sitting, and discussed various matters of local interest, such as the Squatters Law; the formation of Farmers' Associations; the establishment of Co-operative Societies; fruit culture; the desirability of amending the Excise Law; and the exemption of agricultural show grounds and buildings from municipal taxation.

The question of military supplies was also discussed, and instructions given to the secretary to arrange for a meeting in Pretoria, at which the representatives of the military might meet the farmers for the purpose of discussing the position. This meeting was held on the 14th of December, 1904. A deputation was appointed to interview the Lieutenant-Governor, and the whole question was fully discussed, and steps taken to organize the farmers so as to arrange for supplying the needs of the military. A later meeting was held, in the Caledonian Buildings, when Major-General Sir A. B. Dorward and members of his staff were present, and an arrangement was suggested whereby at least 25 per cent. of the requirements of the military forces might be bought direct from the farmers without the acceptance of formal tenders.

It is satisfactory to be able to state that this intention is being liberally interpreted at the present time. This will appear from the statement below, which is taken from the "Weekly Star," and which gives the quantities of various kinds of produce purchased by the military in the three months ending June 30th, 1906. The value of these supplies is something over £22,000. In addition to this tenders from the farmers have been accepted, which make the total amount expended nearly £30,000 :—

"It is pleasing to note that the responsible military officers have thrown their influence into this attempt to bring the producer and consumer into closer touch with each other. This may be specially noted in connection with General Sir A. B. Dorward and General J. F. Burn-Murdoch. The last-named officer reports that in less than three months, from the 1st of April last, he had purchased in the Potchefstroom District 242,300 lbs. of local hay, 4,400 lbs. of locally grown lucerne, 166,800 lbs. of oat hay and lucerne for use at other stations,

and that he is consuming bedding at the rate of 250,000 lbs. per month, all of which is bought locally, direct from the producer.

STATEMENT SHOWING PRODUCE LOCALLY PURCHASED IN SOUTH AFRICA SINCE APRIL 1ST, 1906.

Bought in	Green Forage lbs.	Mealies. lbs	Hay. lbs	Bedding. lbs	Lucerne lbs.	Manna. lbs.	Sweet Grass lbs	Compressed Forage lbs	Mealie Meal lbs.
Cape Colony	—	—	2,407,540	—	1,673,515	—	—	-	—
Transvaal	10,600	1,399,454	1,370,361	323,551	4,434	330,118	1,398	46,360	27,580
O.R Colony	—	518,600	91,584	140,120	11,000		—	—	—
Natal	—	15,000	2,650	—	—	—	-	-	—
Totals	10,600	1,933,054	3,872,135	463,671	1,688,949	330,118	1,398	46 360	27,580

It was in connection with these meetings that the secretary first mooted the question of the establishment of an Agricultural Bank and the erection of storehouses in the chief centres for handling the produce of the farmers of any given district. This has resulted in the appointment of a Land Bank Commission, and there appears to be every likelihood that the scheme will become an accomplished fact.

The next yearly Conference was held in the town of Standerton in January, 1905, under the presidency of Mr. J. Z. de Villiers, M.L.C., and was attended by over forty delegates. The Town Council presented an address of welcome, and placed their buildings at the disposal of the Conference. The native labour question was most fully discussed, and a series of resolutions passed, to be handed in to the Government. These resolutions have been since carried out, in certain directions, by means of an Ordinance recently passed by the Legislative Council. Valuable papers on co-operation, irrigation and agricultural depression were read at this meeting and discussed by the delegates present. A resolution was passed urging the formation of a Transvaal Stock Breeders' Association, and several of the delegates handed in their names as members thereof. A further resolution was passed urging the advisability of establishing an ostrich farm under the supervision of the Agricultural Department, and this year a sum of money has been placed on the estimates for the purpose of commencing this very necessary work. It was reported at this meeting that a Co-operative Society had been formed by a few of the farmers of the Ermelo district for the purchase and working of a threshing machine, and that the project had proved to be most successful. The voting for the office of President of the Union resulted in the election of Mr. J. E. van der

Merwe, of Potchefstroom. He has worthily filled the office up to the present time, having recently been re-elected at the Conference held in Pretoria. Many expressions of appreciation of the able way in which the retiring President, Mr. J. Z. de Villiers, had filled the office were given by the delegates present. The following resolution was unanimously adopted :—"That, in the interest of the farming population, it is desirable to establish Farmers' Banks, where money, on unquestionable security being given, can be secured by the farmer so as to enable him to effect improvements." A number of the delegates paid a visit to the Government Stud Farm, where they were shown round the premises and hospitably entertained by the manager, Capt. C. H. Blackburne.

At a meeting of the Union held in Potchefstroom, in April, 1905, there was a large attendance, owing to the agricultural show being held at the same time. On this occasion the Transvaal Stock Breeders' Association was formed, and nearly a hundred names of members enrolled. The Scab Law also came up for discussion, and a most interesting address was given on the subject by Dr. A. Theiler, the Government Bacteriologist. A deputation was also appointed to give evidence before the Inter-Colonial Irrigation Commission. Captain Madge outlined the proposed Tobacco Growers' Export Association, and the Conference agreed to support the movement. Mr. A. H. Malan handed in a report of the evidence given before the Native Affairs Commission, which was duly received, and Mr. Malan thanked for his services to the Union. The secretary handed in a report as to the steps which had been taken in respect of the disposal of produce to the military, and outlined a scheme for the erection of storehouses for the collection of such produce and its distribution from a central warehouse. He was thanked by the meeting, and instructed to still press the matter, together with the establishment of an Agricultural Bank. A letter was read from the Cape Government Railway stating that reductions in freight had been made on artificial manures, fencing materials, and agricultural implements. Several letters were read from His Excellency Lord Milner in which regret was expressed that he had been unable to meet the request of the Union in respect of contributions from the various Colonies towards the funds of the Inter-Colonial Union.

A special general meeting of the Union was held in Pretoria on the 13th and 14th December, 1905, with special reference to the supply of produce to the military authorities. The secretary read a letter from Lord Selborne, in which His Excellency stated that a promise made by him that he would interest himself in the question of military supplies had been fulfilled, and that he had considered the matter with General Dorward, the Administrator of South Africa. General Dorward had promised to be present at the meeting in order to hear the views of the delegates and explain to them the position of affairs. Upon the arrival of General Dorward and members of his staff the whole question was carefully discussed, and steps taken to secure that the produce of the

farmers should be supplied to the garrison. Lists of the military requirements were handed over to the meeting by Major St. John Parker. At this meeting certain suggestions were made in respect of the Transvaal Scab Law which have since been embodied in the Ordinance, which appears to be working satisfactorily. The question of the establishment of stud sheep farms was also considered, and an estimate of the probable outlay was drawn up. The result of this is that a sum has been placed on the estimates of the current year for the purpose of providing the necessary stock. Several valuable animals have since been purchased and placed on the Government Experimental Farm at Ermelo. The secretary was instructed to thank the High Commissioner for the interest he had taken in the question of military supplies, and also to thank General Dorward and his staff for their assistance. It was announced that the Commissioner of Lands had undertaken to give a further grant, on the pound for pound principle, up to £500, in aid of the funds of the Union, and the secretary was authorised to solicit subscriptions from the public in order to secure this additional grant.

On July 10th, 1906, the annual Conference of the Union was opened in the Town Hall, Pretoria. The public hall had been kindly placed at the disposal of the Union by the Municipality. The High Commissioner opened the Conference and delivered a most stimulating and sympathetic address to the delegates. Many subjects of great importance were dealt with, and the minutes of the Conference have been published in a pamphlet of some 100 pages. Several valuable papers and addresses are included in these minutes, together with maps showing the distribution of locust swarms during the present season. Some 5,000 of these pamphlets have been distributed among the farmers, and copies can still be had by those interested in the proceedings of the Union upon application being made to the secretary, Box 134, P.O. Pretoria. The transactions of the Union in this Conference are so generally known that no good purpose can be served by dealing with them here.

It is hoped that the turning point in the history of the Union has been reached, and that the good work which has been accomplished in the past, and which is very inadequately sketched in the foregoing article, will serve to justify its existence as one of the permanently useful institutions of the Transvaal.

FARM BOOK-KEEPING.

By H. E. King.

WHETHER a man has taken up farming for pleasure or profit, he generally desires to know its annual cost, and when the work is one on which his financial success depends he will further wish to know the cost of each portion of the operations, so that the actual expenditure on any crop or work can be ascertained and an opportunity afforded of observing where possible economies can be effected. Farm accounts will be found both instructing and interesting—there is no reason why they should not be of quite a simple character. It is proposed in this article to set forth a scheme of accounts that can be kept by any farmer—of course with some slight modifications to suit the altered conditions of his particular case.

The primary difficulty in farm book-keeping is to determine the date on which the financial year shall be considered to end, inasmuch as before the last crop has been disposed of, expenditure on the next has often been incurred. This difficulty, however, can be overcome. In this country about July or August will probably be found the most suitable date. Let us then assume that 31st July has been decided upon.

To begin with, the farmer should divide his expenditure into two classes—capital and current expenditure. The first consists of the sums expended in the original purchase of the land, the erection of buildings, the construction of dams and fences and the purchase of plant; the second in recurring expenditure, such as seed, wages and depreciation. There is always a tendency to charge as much as possible to capital account rather than to current expenditure, and this must be guarded against. If it is borne in mind that to the former should be debited only those purchases that represent assets available for use in succeeding as well as the present year, the point becomes a simple one.

The farmer will find that three *main* books are all he requires, *i.e.*, a ledger, journal and cash book, with subsidiary books in which to record the annual stock-taking and the daily transactions. These three main books should, of course, be kept by "double entry." Double entry is a perfectly simple system, and, at the same time, a more accurate manner of showing the position of one's affairs. It consists briefly in making two entries for every transaction. Each transaction necessarily means that some person or account has derived benefit at the expense of another, and, consequently, the entry debits one account and credits another.

In this connection the farmer must learn to consider himself as quite apart from the accounts in his books. He is there represented as a creditor by the capital he originally invested in the farm, and by the profits subsequently made; it makes no difference that a portion or all of the original capital may have been in kind instead of cash.

The three books above-mentioned will be used as follows:—

The *Ledger*, to bring together under particular heads and names the entries in the Journal and Cash Books. No figures must appear in the Ledger from any books other than these two.

The *Journal*.—Entries in the Rough Day Book should be summarised in the Journal, so as to reduce the entries in the Ledger as much as possible, although this should not be done at the expense of perspicuity. When the number of transactions in the month are but few, each one can be copied out in detail into the Journal if desired.

The *Cash Book* is a record of all monies received and of those paid away. The former being, as it were, paid into cash, become a *debit* to "cash account," and, therefore, appear on the left-hand side or "debit" side of the Cash Book, the opposite taking place with *payments*, which are a "*credit*" to cash account. When brought into the Ledger these entries are reversed, *debits* to cash, *i.e.*, receipts, being *credits* to the accounts concerned in the Ledger. This should be clearly understood ; the Cash Book is so often kept incorrectly by the entries appearing on the wrong sides.

Bill Book.—When a large number of Bills or Promissory Notes are accepted, or given in settlement of sales or purchases, a Bill Book can be kept to show due dates, where payable, etc., but if these are few two accounts in the Ledger will do instead: a "Bills Receivable" account for bills or promissory notes accepted in satisfaction of sales made, and a "Bills Payable" account for those given in payment of purchases.

In the *Rough Day Book* will be shown daily all articles, animals, implements, etc., received, sold or issued on loan, the quantity of seed sown, and, generally, the transactions of the day. These will, at certain intervals, be transferred to the Journal.

A "*Labour Book*" is useful if a large number of labourers are employed, but, if not, the work on which each one is engaged can be shown in a diary.

The *Stock Book* will contain a list of all live stock, implements, and other equipment of a non-consumable nature. These should be shown under separate headings for each article. Breakages and losses will be struck off annually.

The foregoing books will be found sufficient for the ordinary farmer.

We will assume that John Smith starts farming on land purchased on the instalment system, on which he has paid one instal-

ment, that he has 500 sheep, 6 mules and 12 oxen, and £1,000 cash. The opening entries will then be as follows:—

(*a*) Hartebeestefontein No. 999, Potchefstroom ..	Dr.	£1,200 0 0	
To Land Investment Co.	Cr.		£1,200 0 0
Purchase price of farm, payable in 60 half-yearly instalments with interest at 5% per annum.			

Although the amount has not been paid, John Smith has incurred a liability to the Land Investment Co. of £1,200, and, therefore, that sum must appear at the Credit of the Company until extinguished by payments. At the same time, the farm is an asset, and the purchase price, therefore, appears at the debit of the account bearing the name of the farm.

(*b*) Land Investment Co. ..	Dr.	£20 0 0	
To John Smith—Capital Account	Cr.		£20 0 0
First instalment of purchase price.			

The amount due to the Land Investment Co. is decreased by this payment, and the balance now owing is only £1,180. John Smith paid the sum from his own pocket, and it must, therefore, be shown as a portion of the capital he invests in the business.

(*c*) Mule a/c—6 mules ..	Dr.	£120 0 0	
Sheep a/c—500 sheep	..	500 0 0	
Oxen a/c—12 oxen	..	144 0 0	
National Bank—paid in	..	1,000 0 0	
To J. Smith—Capital Account			£1,764 0 0

The remarks in the foregoing paragraph apply also to these entries. John Smith has invested in the concern a sum of £1,784 in all, in cash and kind, and, therefore, he is shown as a *Creditor* for that amount. In other words, the business owes John Smith £1,784 which he has lent to it.

It is as well to open accounts for each class of animal so that the profit or loss on each can be ascertained. It will be seen this has been done.

The cash, £1,000, is paid into the bank, which is *debited* with all *deposits* and *credited* with the *sums drawn out*, as shown hereafter.

Having obtained possession of the farm, it is necessary to fence it, erect buildings, purchase implements and seeds, and possibly construct a dam. Accounts should be opened in the Ledger under the heads—Fencing, Implements and Equipment, Dam and Water Race, Dwelling House, Stable and Outhouses, Furniture, etc., against which must appear all expenditure in each connection. Other necessary accounts will be Mules a/c, Sheep a/c, Cattle a/c, Seeds a/c,

Manure a/c, Wages a/c, General Charges, Bank a/c, Profit and Loss, Mealies a/c, Oats a/c, Wheat a/c, Lucerne a/c, Poultry a/c, etc., J. Smith, Capital a/c, J. Smith, Personal a/c.

Now, as the general intention of these Ledger accounts is to enable the expenditure under any head to be clearly shown, each crop should, properly speaking, bear its share of the wages, seeds, and manure, put into it. It will probably, however, be found impracticable to arrive at the correct proportion of the former, and the whole of the wages can, therefore, be treated as general expenditure. The seed and manure used should, however, be estimated and *debited* to the crop obtaining the benefit, seeds and manure accounts being *credited* accordingly.

When these crops are afterwards sold the total amount realised goes to the *credit* of the account, the difference between the *debit* and *credit* sides representing the profit made.

In some cases a portion of crop will be utilised as fodder. The animals consuming it are thereby benefited, and must, therefore, pay for the fodder. Sheep a/c, or whichever one is concerned, is *debited*, and the Crop a/c *credited* as if an actual sale had been made.

We trust that J. Smith is a successful farmer, and not being pressed for money will sometimes desire to hold over a crop until after the date agreed on as the end of his financial year. In such a case, and to allow his books to be closed, the value of the crop should be estimated, and that account *credited*; the difference is then the profit for the year.

When he arrives at the end of his financial year, certain entries are necessary to enable the balance sheet to be drawn up.

All the animals should be re-valued annually, and stock taken of the implements, waggons, and other equipment, seeds, manures, etc., remaining on hand. Permanent improvements, *i.e.*, buildings, fences, water furrows, etc., should not be re-valued, a definite rate of depreciation being written off instead.

It must be here pointed out that an acreage of land ploughed up in preparation for next year's crop is an asset just as much as a bag of mealies, and any work so done should be valued, Wages a/c being *credited*, and an account opened to show the *debit* to be carried forward thus:—

Oats—1906-7	Dr.	£15 0 0	
To Wages			£15 0 0
Cost of ploughing up 20 acres for 1906-7 @ 15/.			

The depreciation to be written off annually can be left to the discretion of the farmer, but the following are suggested as reasonable in this country:—Buildings: Brick, 5%; Wood and Iron, 10%; Fences, 5%; Water Furrows, 5%; Furniture, 15%. Any additional expenditure, other than ordinary repairs, incurred during the year, shall be *debited* to these accounts before the depreciation is written off. The life of implements in a Colony being but short, a re-valuation

is sometimes better than a deduction of depreciation, which may not cover the actual deficiency in value.

Where a large number of live stock are concerned, it is well to call in an independent valuer to check the owner's valuation, which has a tendency to err on the side of excess, and thus unduly inflate the profit made during the year.

In regard to deaths of animals it has been found useful to have a "Mortality" account, to which to *debit* all such losses, otherwise a considerable appreciation per head in the value of sheep, for instance, might be entirely extinguished and lost sight of by the deaths occurring.

One account, it will be seen, is styled J. Smith, *Personal* account. This is to show his drawings during the year, and the total will be carried, at the close of the year, to the *debit* of Profit and Loss. *Capital account* is affected only by the profits and losses made, and not directly by the cash drawn out.

Before passing to some illustrations showing how the above entries will appear in practice, a few words as to the use of the *Cash Book* are necessary:—

Cash account, as represented by the Cash Book, has to account for all monies received, and it does so by showing the payments made and the balance remaining in the bank. It is a good plan to *deposit all receipts in the bank*, and to make *all payments*, as far as possible, *by cheque*. Do not on any account mix up cash drawn out for personal use with the farm's cash. Should it be necessary to use the former to meet urgent expenditure, draw a cheque subsequently in favour of J. Smith to recoup him for the monies so advanced from his private purse. By the use of two columns in the Cash Book, the Bank account can be kept there and checked at intervals with the Bank pass book. In many respects, the Cash Book is the most important of the three *main* books, as so many entries originate there, and care should, therefore, be taken that the use of the book is clearly understood.

Examples of the entries that will probably be made in the course of the year are now given:—

HARTEBEESTEFONTEIN NO. 999. POTCHEFSTROOM

1905					1906.				
July 1.	To Land Inv. Co.	£1,200	0	0	July 31	By Balance ...	£1,200	0	0
1906.									
Aug. 1.	To Balance	£1,200	0	0					

LAND INVESTMENT CO.

1905.					1905.				
July 10.	To J. Smith, Cap. a/c	£20	0	0	July 1.	By Hartebeestefntn.	£1,200	0	0
July 31.	" Balance	1,180	0	0					
		£1,200	0	0			£1,200	0	0
					1906.				
					Aug. 1.	By Balance ...	£1,180	0	0

John Smith. Capital Account.

1906.			1905.		
July 31.	To Balance ...	£2,008 13 10	July 1.	By Sundries ...	£1,764 0 0
			„ 10.	„ Land Investm't Co.	20 0 0
			1906.		
			July 31.	„ Profit and Loss	224 13 10
		£2,008 13 10			£2,008 13 10
			1906.		
			Aug 1.	By Balance ...	£2,008 13 10

John Smith Personal Account

1905.			1906		
Aug. 5.	To Cash	£10 0 0	July 31.	By Profit and Loss A/c ...	£148 15 0
„ 6.	„ Cash	4 10 0			
„ 7.	„ Cash	10 0 0			
Sept. 1.	„ Cash	2 5 0			
„ 14.	„ Cash	5 0 0			
„ 30.	„ Cash	3 0 0			
Oct. 19.	„ Cash	10 0 0			
Nov. 5.	„ Cash	5 0 0			
„ 21.	„ Cash	4 0 0			
Dec. 3.	„ Wheat a/c, 5 bags for own use ...	4 0 0			
„ 24.	„ Cash	10 10 0			
„ 31.	„ Potatoes a/c, 3 bags for house	2 5 0			
1906.					
Jan. 4.	To Cash ...	7 10 0			
Feb. 28.	„ Cash	8 15 0			
Mar. 29.	„ Cash	10 0 0			
Apl. 30.	„ Cash	12 10 0			
May 23.	„ Cash	9 0 0			
„ 25.	„ Cash	3 10 0			
June 28.	„ Cash ...	7 0 0			
July 31.	„ Pigs a/c—Pigs killed for house	2 10 0			
„ 31.	„ Poultry a/c—Eggs and poultry	7 10 0			
„ 31.	„ Dairy a/c—Milk and butter used in house ...	10 0 0			
		£148 15 0			£148 15 0

Fencing Account.

1905.			1906.		
Aug. 7.	To T. W. Beckett & Co.	£51 10 0	July 31.	By Depreciation	£5 0 0
„ 20.	„ Poynton Bros. ...	64 18 0	„ 31.	„ Balance ...	147 8 0
„ 29.	„ Erection ...	36 0 0			
		£152 8 0			£152 8 0
1906.					
Aug. 1.	To Balance	£147 8 0			

DAM AND WATER RACE.

1905.			1906.		
Aug. 3.	To E. Smith & Co. ...	£10 19 0	July 31.	By Depreciation (nominal)	£5 0 0
,, 5.	,, C. Layton ...	21 16 0	,, 31.	,, Balance	177 15 0
,, 31.	,, J. Brown on a/c contract... ...	25 0 0			
Sept. 24.	,, do. do. ...	50 0 0			
Oct. 30.	,, do. do. ...	60 0 0			
1906.					
Apl. 30.	,, do. Balance ...	15 0 0			
		£182 15 0			£182 15 0
1906.					
Aug. 1.	To Balance	£177 15 0			

In contract work of this description it is usual to withhold a portion of money for some months until the efficiency of the work has been proved—in this case 10% was retained for six months.

As the work was completed as late as 30th October, it would, in this instance, be obviously unfair to write off the full annual rate of depreciation—hence a nominal sum, £5, only has been struck off.

DWELLING HOUSE ACCOUNT.

1905.			1906.		
Aug. 6.	To T. Robinson a/c contract ...	£30 0 0	July 31.	By Depreciation (nominal)	£5 0 0
,, 31.	,, do do ...	35 0 0	,, 31.	,, Balance ...	205 0 0
Sept. 10.	,, do. do. ...	100 0 0			
,, 25.	,, do Balance	45 0 0			
		£210 0 0			£210 0 0
1906.					
	To Balance	£205 0 0			

STABLE AND OUTHOUSES.

1905.			1906.		
Aug. 12.	To J. Jack, Ltd., for material ...	£25 1 0	July 31.	By Depreciation ...	£3 0 0
,, 19.	,, Mosenthal Bros., for timber ...	26 4 0	,, 31.	,, Balance ...	78 15 0
Sept. 30.	,, Wages	30 10 0			
		£81 15 0			£81 15 0
1906.					
Aug. 1.	To Balance	£78 15 0			

The work of erecting the latter was performed by J. Smith himself, assisted by natives, hence the debit of £30 10s. In this instance, as also in the previous case (dwelling house), a nominal depreciation only is written off.

FURNITURE ACCOUNT.

1905.			1906.		
Oct. 12.	To T.W. Beckett & Co.	£54 16 0	July 31.	By Depreciation, 10%	£5 9 8
			,, 31.	,, Balance	49 6 4
		£54 16 0			£54 16 0
1906.					
Aug. 1.	To Balance	£49 6 4			

Tools, Implements and Plant.

1905.						1906.				
Sept. 8.	To J. Pairrs ...	£11	16	0		July 31.	By Balance ...	£67	5	6
Dec. 16.	„ Poynton Bros ...	15	19	0						
1906.										
Feb. 10.	„ Howard Farrar ...	26	5	0						
Apl. 24.	„ W. Fris & Sons ...	5	15	6						
July 10.	„ A. Green	7	10	0						
		£67	5	6				£67	5	6
1906.										
Aug. 1.	To Balance	£67	5	6						

From this account, owing to the varying and late dates of purchase, no depreciation has been written off, but 20% should be deducted annually in future off the total purchases.

To this head should be debited *non-consumable* articles *only.*

General Charges

1905.						1906.				
Aug. 1.	To Grease, etc. ...	£0	17	0		July 31.	By Profit and Loss	£101	12	6
Sept. 7.	„ Repairs to Harness	1	4	0						
„ 30.	„ Sundries	4	1	0						
Nov. 11.	„ Ploughshares, etc ...	2	15	0						
1906.										
Feb. 2.	„ Repairs to plough...	2	16	0						
Mar. 19.	„ Sundries	1	19	6						
May 31.	„ Sundries	3	4	0						
July 31.	„ Bank Charges ...	1	16	0						
„ 31.	„ Interest	59	0	0						
„ 31.	„ Hay for Mules ...	5	0	0						
„ 31.	„ Hay for Cattle ...	7	10	0						
„ 31.	„ Barley for Mules ...	5	0	0						
„ 31.	„ Barley for Cattle...	6	10	0						
		£101	12	6				£101	12	6

All *consumable* stores, other than seeds and manures, should be charged to this account and the entire amount written off to profit and loss at the end of each year.

Wages.

1905.						1905.				
Aug. 31.	To Cash	£12	0	0		Sept. 30.	By Stables account	£30	10	0
Sept. 30.	„ Cash	12	10	0		1906.				
Oct. 31.	„ Cash	13	5	0		July 31.	„ Profit and Loss...	126	15	0
Nov. 30.	„ Cash	14	0	0		„ 31.	„ Oats, 1906/7 ...	15	0	0
Dec. 31.	„ Cash	17	10	0						
1906.										
Jan. 31.	„ Cash	9	10	0						
Feb. 28.	„ Cash	9	10	0						
Mar. 31.	„ Cash	12	5	0						
Apl. 30.	„ Cash	12	0	0						
May 31.	„ Cash	12	0	0						
June 30.	„ Cash	16	0	0						
July 31.	„ Cash	31	15	0						
		£172	5	0				£172	5	0

SEEDS ACCOUNT.

1905.						1905.					
July 31.	To Cash	£20	10	0		July 31.	By Potatoes Crop ...	£6	0	0
Dec. 10.	„ Cash	17	5	0		„ 31.	„ Oats „ ...	10	5	0
1906.						„ 31.	„ Wheat „ ...	4	0	0
Jan. 4.	„ Cash	35	16	0		„ 31.	„ Barley „ ...	3	15	0
„ 10.	„ Cash	7	5	0		Sept. 26.	„ Mealie „ ...	30	10	0
						Oct. 31.	„ Lucerne „ ...	5	5	0
						Dec. 31.	„ Potatoes „ ...	7	5	0
						Jan. 31.	„ Potatoes „ ...	11	0	0
							Balance	2	16	0
		£80	16	0				£80	16	0
1906.										
Aug. 1.	To Balance	£2	16	0						

MANURE ACCOUNT.

1905.					1905.					
July 4.	To Cash ..	£10	0	0	July 31.	By Oats Crop ...	£6	10	0
„ 6.	„ Cash	5	5	0	„ 31.	„ Wheat „ ...	2	15	0
					„ 31.	„ Barley „ ...	3	5	0
					„ 31.	„ Balance	2	15	0
		£15	5	0			£15	5	0
1906.									
Aug. 1.	To Balance	£2	15	0					

MEALIE CROP, 1905-6.

1905.					1906.				
Sept. 26.	To Seeds a/c ...	£30	10	0	June 20.	By Cash			
Nov. 6.	„ Cash –					Mealies sold ...	£55	0	0
	Ploughing 50				July 31.	„ Estimated value			
	acres at 15s	37	10	0		of stock on hand	120	0	0
1906.									
July 31.	To Profit & Loss a/c—								
	Profit on crop...	107	0	0					
		£175	0	0			£175	0	0
1906.									
Aug. 1.	To Balance	120	0	0					

From various causes the farmer could not undertake the ploughing of the land for this crop; he, therefore, gave out a contract for the work which was paid for in cash.

OATS, 1905-6.

1905.					1905.				
July 31.	To Seeds a/c ...	£10	5	0	Dec. 5.	By Cash	£25	10	0
„ 31.	„ Manure a/c ...	6	10	0	„ 20.	„ Cash	30	15	0
Nov. 1/30.	„ Cash –				1907.				
	Hire of reapers	9	10	0	Feb. 27.	„ Cash	26	0	0
1906.									
July 31.	To Profit and Loss	56	0	0					
		£82	5	0			£82	5	0

Oats. 1906-7.

1906.			1906.		
July 31.	To Wages a/c— Ploughing 20 acres at 15s.	£15 0 0	July 31.	By Balance	£15 0 0
1906.					
Aug. 1.	To Balance	15 0 0			

Wheat, 1905-6

1905.			1905.		
July 31.	To Seed a/c	£4 0 0	Dec. 3.	By Personal a/c ...	£4 0 0
" 31.	" Manure a/c ...	2 15 0	1906.		
Dec. 30.	" Cash— Threshing ...	3 0 0	Jan. 28.	" Cash	29 0 0
1906.					
July 31.	To Profit and Loss...	23 5 0			
		£33 0 0			£33 0 0

Barley. 1905-6

1905.			1905.		
July 31.	To Seeds a/c... ...	£3 15 0	Aug. 31.	By Cash sales for month ...	£9 0 0
" 31.	" Manure a/c ...	3 5 0	Sep 10	" do. do	10 10 0
Aug. 10.	" Cash— Extra labour, irrigating ...	3 0 0	Oct 30	" do do. ...	6 0 0
1906.			1906		
July	To Profit and Loss a/c	27 0 0	July 31	To Mules' feed ...	5 0 0
			" 31	" Cattle feed ...	6 10 0
		£37 0 0			£37 0 0

Barley to the value of £11 10s. was fed to animals during the winter. As this would be issued in small quantities from the land, the details should be taken for the Rough Day Book and one total shown at the end. of the year.

Lucerne, 1905-6

1905.			1905.		
Oct. 31.	To Seeds a/c... ...	£5 5 0	Dec 11.	By Cash	£15 0 0
Nov. 30.	" Cash— Extra labour ...	4 0 0	1906.		
1906.			Jan. 31	" Cash ...	16 10 0
Jan. 31.	To do. do ...	4 10 0	Feb. 28.	" Cash	17 10 0
Feb. 28.	" do. do ...	7 5 0	Mar. 31.	" Cash	47 13 6
Mar. 31.	" do. do. ...	9 10 0	July 31.	" Sheep a/c... ...	20 0 0
" 31.	" Railage to market	23 5 0	" 31.	" Dairy a/c ...	20 0 0
July 31.	" Profit & Loss a/c	82 18 6			
		£136 13 6			£136 13 6

Potatoes, 1905-6.

1905.			1905.		
Aug. 1.	To Seeds a/c... ...	£6 0 0	Dec 31.	By Personal a/c ...	£2 5 0
1906.			1906.		
Dec. 31.	" do.	7 5 0	Jan. 10.	" Cash	21 16 0
1906.			Jun. 16	" Cash	40 12 6
Jan. 31.	" do.	11 0 0	July 10.	" Cash	66 17 0
June 3.	" Cash—Railage ...	6 9 0	" 31.	" Pigs a/c	3 0 0
July 1.	" " " ...	11 14 0	" 31.	" Stock on hand ...	130 0 0
" 31.	" Profit and Loss ...	222 2 6			
		£264 10 6			£264 10 6
1906.					
Aug. 1.	To Balance... ...	£130 0 0			

Grass-Hay, 1905-6.

1906.			1906.		
Feb. 20.	To Cash— Extra labour cutting & stacking	£17 5 0	May 31.	By Cash	£4 18 6
			Jun. 30.	„ Cash	12 10 0
			July 31.	„ Mule feed ...	5 0 0
July 31.	„ Profit and loss ...	41 13 6	„ 31.	„ Cattle feed ...	7 10 0
			„ 31.	„ Stock in hand ...	29 0 0
		£56 18 6			£56 18 6
1906.					
Aug. 1.	To Balance	£29 0 0			

Miscellaneous Revenue.

1906.			1906.		
July 31.	To Profit and Loss...	£16 16 6	Feb. 27.	By Cash Sale of Fruit ...	£3 16 6
			Mar. 10.	„ Cash Sale of Hides ...	2 4 0
			Mar. 31.	„ Cash Sale of Sand ...	1 16 0
				Sale of bush timber	3 0 0
			Apl. 4.	„ Cash— Sale of Stone ...	6 0 0
		£16 16 6			£16 16 6

Tree-Planting Account.

1905.			1906.		
Dec. 4.	To Cash Ploughing Land	£25 0 0	July 31.	To Balance... ...	£52 10 0
„ 31.	„ Cash Purchase of Trees	12 10 0			
1906.					
Jan. 31.	„ Cash Planting of Trees	15 0 0			
		£52 10 0			£52 10 0
1906.					
Aug. 1.	To Balance	£52 10 0			

The book balance of this account should be carried forward year by year. At certain intervals, say, every five years, the trees can be re-valued and the difference carried to Profit and Loss Account. It is not advisable to do this annually.

Sheep Account.

1905.			1906.		
July 1.	To J. Smith, Cap. a/c	£500 0 0	Jan. 4.	By Cash Sale of Wool	£34 0 0
Aug. 10.	„ Cash – Rams bot.	30 0 0			
„ 31.	„ Cash – Sheep dip	2 10 0			
Nov. 30.	„ Cash—Shearing	5 0 0			
1906.			July 31.	By Mortality a/c ...	30 0 0
July 31.	„ Lucerne, 1905/6...	20 0 0	„ 31.	„ Stock on hand, as per list ...	580 0 0
„ 31.	„ Profit and Loss...	86 10 0			
		£644 0 0			£644 0 0
1906.					
Aug. 1.	To Balance	£580 0 0			

CATTLE ACCOUNT.

1905.			1905.		
July 1.	To J. Smith, Cap. a/c	£144 0 0	Sept. 21.	By Mortality a/c ...	£12 0 0
			1906.		
			July 31.	„ Stock on hand ...	132 0 0
		£144 0 0			£144 0 0
1906.					
Aug. 1.	To Balance	£132 0 0			

MULES ACCOUNT.

1905.			1906.		
July 1.	To J. Smith, Cap a/c	£120 0 0	July 31.	By Stock on hand ...	£114 0 0
			„ 31.	„ Profit and Loss...	6 0 0
		£120 0 0			£120 0 0
1906.					
Aug. 1.	To Balance	£114 0 0			

These mules were re-valued at £19 only, leaving a depreciation of £6 to be borne by the year's expenditure.

PIGS ACCOUNT

1905.			1906.		
July 29.	To Cash—12 Pigs ...	£25 0 0	Jan. 10	By Cash	£5 0 0
Aug. 10.	„ Cash— Mealies ...	6 0 0	July 31.	„ J Smith, Personal a/c	2 10 0
1906.					
July 31.	„ Potatoes, 1905/6...	3 0 0	„ 31.	„ Stock on hand ...	32 10 0
„ 31.	„ Profit and Loss ...	6 0 0			
		£40 0 0			£40 0 0
1906.					
Aug. 1.	To Balance	£32 10 0			

HORSES ACCOUNT.

1905.			1906.		
Oct. 1.	To Cash—2 Horses ...	£40 0 0	July 31.	By Stock on hand ...	£40 0 0
1906.					
Aug. 1.	To Balance	£40 0 0			

Cattle, mules and horses being used for the general work of the farm, the cost of their upkeep forms a debit to general charges.

Food-stuffs supplied to breeding stock should be debited to those accounts, *i.e.*, sheep, pigs, poultry, etc.

POULTRY ACCOUNT.

1905.			1906.		
Aug. 4.	To Cash—Birds purchased... ...	£10 10 0	July 31.	By J. Smith, Personal a/c	£7 10 0
Oct. 26.	„ Cash—Sundries ...	4 15 0	July 31.	„ Cash Sales of Eggs	3 0 0
1906.					
July 31.	„ Profit and Loss ...	6 5 0	July 31.	„ Stock on hand .	11 0 0
		£21 10 0			£21 10 0
1906.					
Aug. 1.	To Balance	£11 0 0			

Mortality Account.

1905.					1906.			
Sept. 21.	To Cattle a/c ...	£12	0	0	July 31.	By Profit and Loss...	£42	0	0
1906.									
July 31.	„ Sheep a/c ...	30	0	0					
		£42	0	0			£42	0	0

Dairy Account.

1905.					1905.				
Oct. 4.	To Bills Payable Stock purchased ...	£120	0	0	Nov. 30.	By Cash Milk sold	£2	0	0
					1906.				
Nov. 1.	To Cash Foodstuffs	11	5	0	Dec. 31.	„ Cash— do.	2	10	0
1906.					Jan. 31.	„ Cash - do.	3	0	0
July 31.	„ Lucerne a/c— Green Fodder...	20	0	0	Feb 28.	„ Cash - do.	4	0	0
„ 31.	„ Profit & Loss a/c ...	21	5	0	Mar. 31.	„ Cash do	4	10	0
					Apl. 30	„ Cash do.	4	10	0
					„ 30	„ B/R a/c, Calves sold	8	0	0
					May 31.	„ Cash Milk sold	3	10	0
					June 30	„ Cash — do	3	0	0
					July 31.	„ Cash do	2	10	0
					„ 31.	„ B/R a/c, Calves sold	11	0	0
					„ 31.	„ J. Smith, Personal a/c, Milk and Butter for year	10	0	0
					„ 31	„ Stock on hand ...	114	0	0
		£172	10	0			£172	10	0
1906.									
Aug 4.	To Balance	£114	0	0					

Bills Payable Account

1906.					1905.				
Apl 4.	To Balance	£120	0	0	Oct 4.	By Dairy a/c	£120	0	0
					1906.				
					Aug. 1	By Balance	£120	0	0

Bills Receivable Account.

1906.					1906.				
Apl. 30.	To Dairy a/c... ...	8	0	0	July 31	By Balance...	£19	0	0
July 31.	„ do Calves sold on P/ notes	11	0	0					
		£19	0	0			£19	0	0
1906.									
Aug. 1.	To Balance ...	£19	0	0					

Petty Cash Account.

1905.					1905.				
Aug. 1.	To Cash	£5	0	0	Sept. 30.	By General Charges Account ...	£4	1	0
1906.					1906.				
Mar. 15.	„ Cash	5	0	0	May 31.	„ General Charges Account ...	3	4	0
					July 31.	„ Cash in hand ...	2	15	0
		£10	0	0			£10	0	0
1906.									
Aug. 1.	„ Balance.	£2	15	0					

BANK ACCOUNT.

Date	Particulars	£	s.	d.	Date	Particulars	£	s.	d.
1905.					1905.				
July 1.	To Balance in Cash	£1,000	0	0	Aug. 31.	By Cash Drawings...	£420	15	0
Aug. 31.	„ Cash Deposits ..	9	0	0	Sept. 30.	„ Cash Drawings...	230	15	0
Sept. 30.	„ Cash Deposits ...	10	10	0	Oct. 31.	„ Cash Drawings...	182	16	0
Oct. 31.	„ Cash Deposits ...	6	0	0	Nov. 30.	„ Cash Drawings...	93	0	0
Nov. 30.	„ Cash Deposits ...	2	0	0	Dec. 31.	„ Cash Drawings...	101	14	0
Dec. 31.	„ Cash Deposits	73	15	0	1906.				
1906.					Jan. 31.	„ Cash Drawings...	79	11	0
Jan 31.	„ Cash Deposits ...	109	6	0	Feb 28.	„ Cash Drawings	71	16	0
Feb. 28.	„ Cash Deposits	51	6	6	Mar 31.	„ Cash Drawings	61	19	6
Mar 31.	„ Cash Deposits ..	59	3	6	Apl 30.	„ Cash Drawings .	15	5	6
Apl. 30.	„ Cash Deposits ...	10	10	0	May 31.	„ Cash Drawings...	24	10	0
May 31.	„ Cash Deposits ...	8	8	6	June 30	„ Cash Drawings. .	29	9	0
June 30.	„ Cash Deposits	111	2	6	July 31.	„ Cash Drawings. .	170	14	0
July 31.	„ Cash Deposits ...	72	7	0	„ 31.	„ Charges	1	16	0
					„ 31.	„ Balance ...	9	8	0
		£1,523	9	0			£1,523	9	0
1906.									
Aug 1.	To Balance ...	£9	8	0					

Dr. CASH ACCOUNT *Cr.*

Date	Particulars	Details	Bank	Date	Particulars	Details	Bank
1905. July.				1905.			
31.	To Balance at Bank ...		£1,000 0 0	Aug			
Aug. 31.	„ Barley a/c ...	£9 0 0	9 0 0	1	By Gen Charges	0 17 0	
				1	„ Petty Cash...	5 0 0	
				3.	„ Dam a/c ...	10 19 0	
				4.	„ Poultry a/c	10 10 0	
				5.	„ Personal a/c	10 0 0	
				5.	„ Dam a/c ...	21 16 0	
				6	„ Personal a/c	4 10 0	
				6.	„ Dwel Hse. a/c	30 0 0	
				7.	„ Personal a/c	10 0 0	
				7.	„ Fencing a/c	51 10 0	
				10.	„ Sheep a/c ...	30 0 0	
				10.	„ Pigs a/c ...	6 0 0	
				10	„ Barley a/c ...	3 0 0	
				12.	„ Stable a/c ...	25 1 0	
				19	„ Stable a/c ...	26 4 0	
				20	„ Fencing a/c	64 18 0	
				29.	„ Fencing a/c	36 0 0	
				31.	„ Dam a/c ...	25 0 0	
				31	„ Dwel Hse a/c	35 0 0	
				31	„ Wages a/c ...	12 0 0	
				31.	„ Sheep a/c ...	2 10 0	
							420 15 0
Sept. 30.	„ Barley a/c ...	10 10 0	10 10 0	Sept. 1.	„ Personal a/c	2 5 0	
				3.	„ Implemts. a/c	11 16 0	
				7.	„ Gen. Charges	1 4 0	
				10.	„ Dwel. Hse a/c	100 0 0	
				14.	„ Personal a/c	5 0 0	
				24.	„ Dam a/c ...	50 0 0	
				25.	„ Dwel. Hse. a/c	45 0 0	
				30.	„ Personal a/c	3 0 0	
				30.	„ Wages a/c ...	12 10 0	
							230 15 0
	Carried ford.	£19 10 0	£1,019 10 0		Carried ford.	£651 10 0	£651 10 0

Dr. CASH ACCOUNT (continued). *Cr.*

	Brought ford.	£19 10 0	£1,019 10 0
Oct.			
30. „	Barley a/c ...	6 0 0	6 0 0
Nov.			
30. „	Dairy a/c ...	2 0 0	2 0 0
Dec.			
5. „	Oats a/c ...	25 10 0	
11. „	Lucerne a/c	15 0 0	
20. „	Oats a/c ...	30 15 0	
31. „	Dairy a/c ...	2 10 0	73 15 0
1906.			
Jan.			
4. „	Sheep a/c ...	34 0 0	
10. „	Potatoes a/c	21 16 0	
10. „	Pigs a/c ...	5 0 0	
28. „	Wheat a/c ...	29 0 0	
31. „	Lucerne a/c	16 10 0	
31. „	Dairy a/c ...	3 0 0	109 6 0
Feb.			
27. „	Oats a/c ...	26 0 0	
27. „	Misc Revenue	3 16 6	
28. „	Lucerne a/c	17 10 0	
28. „	Dairy a/c ...	4 0 0	51 6 6
Mar.			
10. „	Misc. Revenue	2 4 0	
31. „	Lucerne a/c	47 13 6	
31. „	Dairy a/c ...	4 10 0	
31. „	Misc. Revenue	1 16 0	
31. „	do. do. ...	3 0 0	59 3 6
Apl.			
4. „	do. do. ...	6 0 0	
30. „	Dairy a/c ...	4 10 0	10 10 0
May.			
31. „	Grass a/c ...	4 18 6	
31. „	Dairy a/c ...	3 10 0	8 8 6
	Carried ford.	£339 19 6	£1,339 19 6

	Brought ford.	£651 10 0	£651 10 0
Oct.			
1. „	Horses a/c ...	40 0 0	
12. „	Furniture a/c	54 16 0	
19. „	Personal a/c	10 0 0	
26. „	Poultry a/c	4 15 0	
30. „	Dam a/c ...	60 0 0	
31. „	Wages a/c ...	13 5 0	182 16 0
Nov.			
1. „	Dairy a/c	11 5 0	
5. „	Personal a/c	5 0 0	
6. „	Mealie Crop	37 10 0	
11. „	Gen. Charges	2 15 0	
21 „	Personal a/c	4 0 0	
30. „	Wages a/c ...	14 0 0	
30. „	Sheep a/c ...	5 0 0	
30. „	Oats a/c ...	9 10 0	
30. „	Lucerne Crop	4 0 0	93 0 0
Dec.			
4. „	Tree Plantg	25 0 0	
10 „	Seeds a/c ...	17 5 0	
16. „	Implemts. a/c	15 19 0	
24. „	Personal a/c	10 10 0	
30. „	Wheat a/c ...	3 0 0	
31. „	Wages a/c ...	17 10 0	
31. „	Tree Plantg.	12 10 0	101 14 0
1906.			
Jan			
4. „	Personal a/c	7 10 0	
4. „	Seeds a/c ...	35 16 0	
10. „	Seeds a/c ...	7 5 0	
31. „	Wages a/c ...	9 10 0	
31. „	Tree Plantg.	15 0 0	
31. „	Lucerne Crop	4 10 0	79 11 0
Feb.			
2. „	Gen. Charges	2 16 0	
10. „	Implements and Tools	26 5 0	
20. „	Grass Crop...	17 5 0	
28 „	Personal a/c	8 15 0	
28. „	Wages a/c ...	9 10 0	
28. „	Lucerne Crop	7 5 0	71 16 0
Mar.			
15. „	Petty Cash...	5 0 0	
19. „	Gen. Charges	1 19 6	
29. „	Personal a/c	10 0 0	
31. „	Wages a/c ...	12 5 0	
31. „	Lucerne Crop	9 10 0	
31. „	do. ...	23 5 0	61 19 6
Apl.			
24. „	Implemts. a/c	5 15 6	
30. „	Personal a/c	12 10 0	
30. „	Dam a/c ...	15 0 0	
30. „	Wages a/c ...	12 0 0	45 5 6
May.			
23. „	Personal a/c	9 0 0	
25. „	do. ...	3 10 0	
31. „	Wages a/c ...	12 0 0	24 10 0
	Carried ford.	£1,312 2 0	£1,312 2 0

Dr. CASH ACCOUNT (continued). *Cr.*

	£	s.	d.	£	s.	d.
Brought ford.	£339	19	6	£1,339	19	6
June.						
16. „ Potatoes a/c	40	12	6			
20. „ Mealies a/c...	55	0	0			
30. „ Dairy a/c ...	3	0	0			
30. „ Grass a/c ...	12	10	0			
				111	2	6
July.						
10. „ Potatoes a/c	66	17	0			
31. „ Dairy a/c ...	2	10	0			
31. „ Poultry a/c	3	0	0			
				72	7	0
	£1,523	9	0	£1,523	9	0

	£	s.	d.	£	s.	d.
Brought ford.	£1,312	2	0	£1,312	2	0
June.						
3. „ Potatoes a/c	6	9	0			
23. „ Personal a/c	7	0	0			
30. „ Wages a/c	16	0	0			
				29	9	0
July.						
1. „ Potatoes a/c	11	14	0			
4. „ Manure a/c	10	0	0			
6. „ do. ...	5	5	0			
10. „ Implemts. a/c	7	10	0			
29. „ Pigs a/c ...	25	0	0			
31. „ Wages a/c ...	31	15	0			
31. „ Gen. Charges	59	0	0			
31. „ Seeds a/c ...	20	10	0			
31. „ Bank Charges	1	16	0			
				172	10	0
31. „ Balance at Bank ...	9	8	0	9	8	0
	£1,523	9	0	£1,523	9	0

TRIAL BALANCE, 31st JULY, 1906.

Folio.		£	s.	d.	£	s.	d.
1.	J. Smith—Capital Account				1,784	0	0
2.	„ Personal Account	148	15	0	—		
3.	Land Investment Co.	20	0	0	1,200	0	0
4.	Hartebeestefontein	1,200	0	0	—		
5.	National Bank	1,523	9	0	1,514	1	0
6.	Petty Cash	10	0	0	7	5	0
7.	Bills Payable	—			120	0	0
8.	„ Receivable	19	0	0	—		
9.	Mortality Account	42	0	0	—		
10.	General Charges	101	12	6	—		
11.	Fencing	152	8	0	—		
12.	Dam and Water Race	182	15	0	—		
13.	Dwelling-house	210	0	0	—		
14.	Stables and Outhouses	81	15	0			
15.	Furniture	54	16	0	—		
16.	Implements and Tools	67	5	6	—		
17.	Wages	172	5	0	45	10	0
18.	Seeds Account	80	16	0	78	0	0
19.	Manure Account	15	5	0	12	10	0
20.	Tree Planting	52	10	0			
21.	Miscellaneous Revenue	—			16	16	6
22.	Sheep Account	557	10	0	64	0	0
23.	Cattle „	144	0	0	12	0	0
24.	Horses „	40	0	0	—		
25.	Mules „	120	0	0	—		
26.	Pigs „	34	0	0	7	10	0
27.	Poultry „	15	5	0	10	10	0
28.	Dairy „	151	5	0	58	10	0
29.	Oats, 1905/6	26	5	0	82	5	0
30.	„ 1906/7	15	0	0	—		
31.	Lucerne Crop	53	15	0	136	13	6
32.	Potato Crop	42	8	0	134	10	6
33.	Grass Hay	17	5	0	29	18	6
34.	Mealie Crop	68	0	0	55	0	0
35.	Wheat „	9	15	0	33	0	0
36.	Barley „	10	0	0	37	0	0
		£5,439	0	0	£5,439	0	0

Profit and Loss Account.

Date		Particulars	£	s.	d.
1906. July 31.	To	Personal a/c, balance transferred ...	£148	15	0
" "	"	Fencing a/c, depreciation	5	0	0
" "	"	Dams & Race, depreciation	5	0	0
" "	"	Dwelling-house, depreciation	5	0	0
" "	"	Stables & Out-houses, depreciation ...	3	0	0
" "	"	Furniture a/c, depreciation	5	9	8
" "	"	General charges, balance transferred ...	101	12	6
" "	"	Wages	126	15	0
" "	"	Mortality a/c, balance transferred ...	42	0	0
" "	"	Mules a/c, depreciation ...	6	0	0
" "	"	J. Smith, Capital a/c, balance transferred ...	248	3	10
			£696	16	0

Date		Particulars	£	s.	d.
1906. July 31.	By	Dairy a/c, profit on a/c ...	£21	5	0
" "	"	Lucerne Crop, profit ...	82	18	6
" "	"	Potatoes, profit...	222	2	6
" "	"	Grass Hay, profit	41	13	6
" "	"	Mealies, profit ...	107	0	0
" "	"	Wheat, profit ...	23	5	0
" "	"	Oats, profit ...	56	0	0
" "	"	Barley, profit ...	27	0	0
" "	"	Pigs, profit ...	6	0	0
" "	"	Poultry, profit...	6	5	0
" "	"	Sheep, profit ...	86	10	0
" "	"	Sundry Revenue, profit ...	16	16	6
			£696	16	0

Balance Sheet.

Date		Particulars	£	s.	d.
1906. July 31.	To	J. Smith, Capital a/c	£2,032	3	10
" "	"	Land Investment Company ...	1,180	0	0
" "	"	Bills payable a/c	120	0	0
			£3,332	3	10

Date		Particulars	£	s.	d.
1906. July 31.	By	Farm	£1,200	0	0
" "	"	Fencing ...	147	8	0
" "	"	Dams and Race	177	15	0
" "	"	Dwelling-house	205	0	0
" "	"	Stables and Out-houses ...	78	15	0
" "	"	Furniture ...	49	6	4
" "	"	Trees	52	10	0
" "	"	Mealies... ...	120	0	0
" "	"	Grass Hay ...	29	0	0
" "	"	Oats, 1906/7 ...	15	0	0
" "	"	Potatoes ...	130	0	0
" "	"	Seeds	2	16	0
" "	"	Manure... ...	2	15	0
" "	"	Implements and Tools... ...	67	5	6
" "	"	Live Stock ...	1,023	10	0
" "	"	Bills receivable	19	0	0
" "	"	Cash at bank ...	9	8	0
" "	"	Cash in hand ...	2	15	0
			£3,332	3	10

I recognise that, in placing before the farmer any system of accounts, it is essential that it be one easily understood. I have, therefore, avoided any complications so as to enable the general principle to be readily grasped and to reduce the amount of clerical

labour involved. When once the use of proper accounts has been adopted they will always be kept up and the result is usually so interesting that the few hours *per week* the work involves will not be grudged.

The scheme of accounts in this article can, of course, be greatly elaborated so as to show expenditure and income under a larger number of heads, and this I may take up in a subsequent issue of this "Journal." In the meantime, the system herein outlined will enable the farmer to ascertain the following essential points:—

(*a*) The profit made during the year.
(*b*) The sources from which that profit has been obtained.
(*c*) His *personal* and *business* expenditure.
(*d*) The heads under which that expenditure can or should be reduced.
(*e*) And the increase of his capital account year by year.

THE CHEMICAL SECTION.

I.]

THE ASH CONSTITUENTS OF FOOD STUFFS.

By Herbert Ingle, B.Sc., F.I.C., etc.

Considerable attention has lately been aroused in South Africa in reference to the prevalence of certain diseases of animals which are alleged to be induced by the deficiency of their food in mineral matter, which, in turn, is ascribed to the peculiarity of many of our soils in containing such small proportions of lime and phosphoric acid.

A brief discussion of the functions of the ash constituents of foods and of the points in which South African produce differs from that of other countries may, therefore, be of interest to our readers.

The Importance of Ash Constituents to Plants.

The larger portion of the structure of a plant is made up of water and organic matter. By organic matter is meant material composed of complex compounds of carbon, oxygen, hydrogen, and nitrogen, and these substances are obtained very largely from the air by the leaves of the plant. The nitrogen, however, is, in the case of nearly all plants, derived from the nitrates existing in the soil, and is absorbed by the roots.

But, in addition, plants contain certain elements which, though they may exist in the plant in the form of complex compounds in combination with some of the organic matter, are left behind in the ashes when the plants are burned in the form of comparatively simple compounds.

The substances are, therefore, called "ash constituents," or, sometimes, mineral matter, since they are obtained from the soil by absorption through the roots.

The elements which are always present in plant ashes are—

Potassium,
Sodium,
Calcium,
Magnesium,
Iron,
Silicon,
Phosphorus,
Chlorine,

in addition to carbon and oxygen which form so large a portion of the organic constituents.

Most of these elements are, perhaps, more familiar in ordinary life under the common names of their compounds with oxygen, as

potash, soda, lime, magnesia, oxide of iron, silica and phosphoric acid. Although the quantity of each of these ingredients in most plants is very small, they are most of them absolutely essential to the growth of a plant.

Thus, if a plant is not supplied, say, with potash in some form, it cannot grow, and soon dies. The same is true of the other constituents with the exception, perhaps, of silica and soda, which, in the case of some plants at least, do not appear to be essential.

The functions which are filled by the various mineral ingredients are not well known, but they appear to be closely related to the physiological processes by which starch, sugar, albuminoids and other important products are formed and moved in the plant.

In the most important act of a plant's life—the formation of seed—a concentration of these ash constituents, as well as of the nitrogenous and carbonaceous materials, from the leaves and stems to the seed takes place, in order that the seed may contain a store of plant food to start the seedling when germination occurs.

In this concentration it generally happens that phosphoric acid and potash are stored in largest amount, while lime, magnesia, chlorine and the other ash constituents, though always present, are there in very small proportion. As a rule, the leaves and stems of a plant contain a higher proportion of these latter elements than the seeds.

It may be of interest to give the proportion of the various ash constituents contained in a few typical vegetable products.

The following figures are from analyses by Wolff:—

A. *Seeds.*

	Wheat.	Oats.	Maize.	Millet.	Peas.	Beans.
Per cent. of Ash in dry substance	2·07	3·07	1·42	4·49	2·81	3·45
Per cent. of Potash in Ash ...	31·1	15·9	27·0	11·9	40·4	40·5
„ Soda „	3·5	3·8	1·5	1·0	3·7	1·2
„ Lime „	3·1	3·8	2·7	1·0	4·2	5·2
„ Magnesia „	12·2	7·3	14·6	8·4	8·0	6·7
„ Phosphoric Acid in Ash...	46·2	20·7	44·7	23·4	36·3	39·2
„ Sulphuric Acid „	2·4	1·6	1·1	0·2	3·5	5·1
„ Silica „ ...	1·7	46·4	2·2	52·3	0·9	1·2
„ Chlorine „ ...	—	—	—	—	2·3	2·9

B. *Straw.*

	Wheat.	Oats.	Maize.	Peas.	Beans.
Per cent. of Ash in dry substance ...	4·96	5·12	5·49	5·74	7·12
Per cent. of Potash in Ash	11·5	22·0	3[illegible]·3	21·8	44·4
„ Soda „	2·9	5·3	1·2	5·3	3·8
„ Lime „	6·2	8·2	10·5	37·9	23·1
„ Magnesia „	2·6	4·0	5·5	7·7	7·8
„ Phosphoric Acid in Ash...	5·4	4·2	8·1	7·8	7·0
„ Sulphuric Acid „ ...	2·9	3·5	5·2	5·6	0·2
„ Silica „ ...	66·3	48·7	38·0	5·7	5·4
„ Chlorine „ ...	—	—	—	6·1	13·8

C. *Hay, Grasses, etc.*

	Meadow Hay.	Timothy.	Oats.	Lucerne.	White Clover.
Per cent. of Ash in dry substance ...	7·78	7·01	7·23	7·14	7·16
Per cent. of Potash in Ash	25·6	28·8	39·0	25·3	17·5
" Soda "	7·0	2·7	3·3	1·1	7·8
" Lime "	11·6	9·4	6·7	48·0	32·0
" Magnesia "	4·9	3·7	3·2	5·8	10·0
" Phosphoric Acid in Ash ...	6·2	10·8	8·3	8·5	14·1
" Sulphuric Acid " ...	5·1	3·9	2·9	6·1	8·8
" Silica " ...	29·6	35·6	33·2	2·0	4·5
" Chlorine " ...	8·0	5·0	4·0	1·9	3·2

D. *Root Crops*

	Potatoes	Mangels	Sugar beets.	Turnips	Carrots.
Per cent of Ash in dry substance ...	3·74	6·86	4·35	8·28	6·27
Per cent. of Potash in Ash	59·8	53·1	49·4	39·3	36·7
" Soda "	1·6	14·8	9·6	11·4	22·1
" Lime "	2·3	4·6	6·3	10·4	10·7
" Magnesia "	4·5	5·1	8·9	3·9	5·3
" Phosphoric Acid in Ash ...	19·1	9·6	14·3	13·3	12·5
" Sulphuric Acid "	6·6	3·3	4·7	14·3	6·4
" Silica " ...	2·3	3·3	3·5	2·4	2·0
" Chlorine " ...	2·8	6·6	2·0	4·1	3·2

The percentages of ash in the above tables refer to the amount of ash contained in 100 parts of the dry substance after the removal of water which, in some of the substances, *e.g.*, roots and green fodder, amounts to a very large proportion, even up to 80 or 90% of the whole weight.

By "phosphoric acid" and "sulphuric acid" in the above tables, phosphorus pentoxide and sulphur trioxide, respectively, are meant. The carbonic acid (carbon dioxide) which constitutes a large proportion of the weight of the ash of plants has been ignored in the above figures. The figures, therefore, do not give a very direct measure of the amounts of the various ash constituents present in a given weight of food, but they do at once convey the ratio between the various constituents themselves.

The following general deductions may be drawn from such analytical results:—

1. That the seeds of plants contain varying quantities of ash—mealies being remarkable for poverty.
2. That phosphoric acid and potash are usually the largest ingredients in the ash of seeds, followed by magnesia, while lime is usually present in small proportion only.
3. That in straw, the amount of lime usually exceeds that of phosphoric acid and also that of magnesia.
4. That lime is particularly abundant in the leaves and stems of leguminous crops, *e.g.*, clovers, lucerne, peas, beans, etc., and, in these, greatly exceeds the phosphoric acid.
5. That, in the straw of cereals and of grasses, silica is often the largest constituent, while in leguminosæ and in roots it is present in very small quantity.

The proportion and composition of the ash of a given plant is liable to variation according to the conditions under which it is grown, and there seems little doubt that, in this country, many crops are poorer in ash constituents generally than the same crops grown in Europe.

This is seen in the case of oats. The following figures show the proportion of ash and of lime and phosphoric acid in several samples of South African grown oat-hay from analyses conducted in our laboratories:—

	Total Ash.	Lime.	Phosphorus Pentoxide.
Middleburg (Cape Colony) ..	6.51	0.091	0.16
Malmesbury " ..	5.21	0.085	0.37
Harmon " ..	4.51	0.13	0.20
Magaliesberg (Transvaal) ..	—	0.118	0.27
Blackspruit " ..	—	0.205	0.33
Potchefstroom " ..	4.23	0.18	0.34
Mean of South African samples	5.09	0.135	0.278

The average figures for oat-hay grown in Europe according to figures given by

Wolff	4.30	0.35	0.51
Warington	4.80	0.29	0.48
Mean	4.55	0.32	0.495

These figures indicate that South African oat-hay contains on the average less than half as much lime and rather more than half as much phosphoric acid as the average of the European samples, though apparently more silica and other ash constituents.

In the case of plants, there seems to be a capability of adaptation to abnormal conditions as to supply of ash-constituents in the soil, though there is little doubt that if the deficiency of lime and phosphates, which is shown by so many of our soils, were made up, larger and better crops would be obtained.

The Requirements of Animals.

For their proper sustenance, animals require that their food contains a proper quantity of nitrogenous compounds (protein or albuminoids), and of carbonaceous compounds (starch, cellulose, sugar or fat), and if the best results are to be obtained, that the ratio of nitrogenous matter to carbohydrates in their food be within certain limits which vary with the kind of animal, its age, and other conditions. This aspect of the question has been well studied, and a

recognition of the importance of a "well-balanced ration" has long been made. The subject was dealt with at some length in this "Journal" (July, 1906, No. 16, Vol IV., pp. 812-818), and need not be further discussed here.

But the functions of the ash-constituents of the food of animals is worthy of more study and attention than it usually receives.

For building up flesh and fat, animals require mainly the proteids, carbohydrates, and fats, which are usually regarded as the only valuable constituents of their food.

But for carrying on the processes of life other constituents are needed.

1. The materials of which bones, teeth and the hard parts of animals are composed must be supplied.
2. The various digestive juices, the blood and other portions of the animal, must contain certain mineral constituents in order to carry on their functions, though these constituents are perhaps not actually used in building up the main tissues of the animal. Moreover, the materials necessary to renew these organs, etc., must be supplied continually.

Our knowledge of all these requirements is not by any means complete, but the following essential substances may be mentioned:—

A. Calcium phosphate and magnesium phosphate, together with small quantities of carbonates, fluorides and chlorides, are present in bones and teeth, and are to be regarded as truly formative materials.

B. Chlorides and hydrochloric acid are contained in the gastric juice. Iodine is present in the thyroid gland. Potassium compounds are present in the saliva, the gastric juice, and many other sections. Iron is present in blood. Sulphur and phosphorus are present in an unoxidised condition in the blood, the brain and other organs.

Consider the substances under A—these include the constituents, lime, magnesia, phosphoric acid, fluorine and chlorine, of which lime and phosphoric acid are by far the largest.

Now, in bones, the lime and phosphoric acid, which, together, constitute about 85% of the total ash-constituents, are usually in the ratio, by weight, of one of phosphorus pentoxide to about one and a half of lime, *i.e.*, of 1 : 1.5.

It would seem, therefore, reasonable to suppose that a food-stuff containing lime and phosphoric acid in approximately this ratio would be most suitable to an animal's requirements. Let us see how near to this ratio are the two constituents in some ordinary foods.

The following table gives the ratio of phosphorus pentoxide to lime in several products calculated from the analyses of Wolff or Warington:—

	Phosphorus Pentoxide.		Lime.
Mealies (grain)	1	:	0.04
Oats (grain)	1	:	0.16
Wheat (grain)	1	:	0.07
Barley (grain)	1	:	0.06
Kaffir corn (grain)	1	:	0.02
Peas (seed)	1	:	0.08
Wheat bran	1	:	0.09
Wheat plant (shooting)	1	:	0.66
Oat plant "	1	:	0.77
Potatoes	1	:	0.15
Turnips	1	:	0.83
Mealie plant (in flower)	1	:	1.35
Meadow hay	1	:	2.27
Cabbages	1	:	2.24
White clover (in flower)	1	:	2.28
Red clover "	1	:	3.60
Lucerne "	1	:	4.78
Pea straw	1	:	4.62

It will be seen how low the ratio of lime to phosphoric acid is in the case of grain (particularly in Kaffir corn and mealies), and that it is also very low in the whole oat plant (*e.g.*, oat-hay) while in the leguminosæ, *e.g.*, lucerne, the clovers and pea straw, it is very high.

In the case of meadow hay, too, it is fairly high, viz., 2.27.

Of South African samples, I may quote the following from analyses made in these laboratories:—

	Phosphorus Pentoxide.		Lime
Oat-hay (mean of 6 samples) ..	1	:	0.507
Boer manna hay	1	:	0.94
Natal blue grass hay	1	:	1.68

It will be seen that the ordinary ration for horses and mules in this country, viz., oat-hay and mealies, contains far too little lime in proportion to phosphoric acid, for what are the probable requirements of the animals.

In Europe, though oats are recognised as a valuable ingredient in the ration of working horses, they practically never form the sole food, and their low ratio of lime to phosphoric acid is compensated by the meadow or clover hay which almost invariably forms a large portion of the diet.

I have, elsewhere, adduced reasons for believing that the prevalence of certain bone diseases of animals in this country is favoured, if not caused, by the almost exclusive use of a diet of oat-hay and mealies, and the consequent administration to the animals of phosphoric acid and lime in unsuitable proportions.

It is to be hoped that, in the future, sufficient lucerne may be grown in this country to enable the ration for horses and mules to be suitably adjusted so that the ratio of its lime to phosphoric acid may be considerably increased, and that, with this change in food,

certain bone diseases, which at present are sources of great loss, may diminish or even disappear.

I may point out that the view that the deficiency of much of our food-stuffs in ash-constituents is the cause of many diseases of stock has been held by many people for some time, but I am not aware that the view here adduced that it is not the lack of phosphoric acid and lime, but rather the improper ratio in which they are present in the general diet, that produces the harmful effects, has hitherto been brought forward.

In the meantime, by the use of veld-grass hay, instead of a portion of the almost universally used oat-hay, it would probably be possible to greatly improve the food of horses and mules from this point of view.

I have dwelt at some length with the substances lime and phosphoric acid in the food of animals since they, we know, are required in considerable quantities to build up the bones. The other constituents, though required in much smaller quantities, are, doubtless, of equal importance to the welfare of the animal.

Some of them, which do not accumulate in any considerable quantity in the body, may be likened in the functions they fulfil to the oil used in lubricating a piece of mechanism. Without them, the processes which have to go on in the body, *e.g.*, digestion, cannot be properly performed, and the animal, consequently, suffers in health.

To take one instance—chlorine. This substance, in the form generally of common salt, is absolutely indispensable to the carrying on of the process of digestion, and though it cannot be described as a true food, is quite an essential ingredient in the diet of an animal.

The same is doubtless true of the other elements mentioned under the heading B, though the quantities required are extremely minute.

In many districts of the Transvaal, *e.g.*, Bloemhof, common salt is abundant, and patches of "brak" soil occur which contain so much saline matter, often chiefly common salt, that they are sterile and unfit to support plant life.

In such districts, cattle, etc., feeding on the veld can obtain abundance of the necessary salt. On the other hand, in certain districts, *e.g.*, Wakkerstroom, salt occurs but sparingly, and the farmers find it necessary to supply their stock with it artificially in the form of "licks." These licks are sometimes merely common salt, in other cases mixtures of common salt with lime, sulphur and other substances.*

* The following gives the results of our examination of a commercial "cattle lick" which has lately been put on the market. The substance was a coarse granular powder, and contained :—

Moisture	4·83
†Loss on Ignition	11·53
Insoluble matter (sand) ...	3·45
Lime	16·44
Magnesia	traces
Phosphoric Acid	12·11
Sulphuric Acid ...	6·60
Sodium chloride	41·32
Potash	1·75
	98·03

†Containing free sulphur, 4·90 ; ammonia, 0·21.

The efficiency of common salt as an aid to digestion is undoubted, but, in the case of other substances required by animals, *e.g.*, sulphur, fluorine, phosphorus, and, perhaps, even lime, it is probable that the compounds of these substances, which occur naturally in plants, are more efficient than artificial concentrated substitutes.

The need of supplementing the deficient supplies of ash-constituents in the general foods of poultry kept in confinement has lately attracted much attention, and concentrated "salts," intended to effect this, have been prepared for the market.

One of these preparations, to whose value strong testimony has lately been furnished, consists of a complex mixture whose chief ingredients are—

Phosphate of lime,
" " magnesia,
" " soda,
Common salt,
Sulphate of potash,
Sulphate of ammonia,
Oxide of iron,
Calcium fluoride.

This mixture would contain phosphoric acid and lime in the ratio of 1 of phosphorus pentoxide to about 0.74 of lime, and, consequently, would seem to require the addition of further lime to be quite favourable for bone formation. However, in the case of poultry, this would be supplied in the form of calcium carbonate, with which everyone recognises it is necessary to supply laying hens. It is probable that the good effects of these "salts" upon fowls is mainly due to their supplying chlorine, iron, sulphates and fluorine, thus increasing the digestive powers and acting as a general tonic.

The use of "bone flour" or "bone meal" as a lick for cattle in districts in which the soil is deficient in lime, and in which certain bone diseases are prevalent, is much advocated in many quarters, and would appear to be useful.

Bone ash would probably be preferable, and its use would avoid the danger of spreading disease which exists when raw bones are employed.

Although bones or bone-ash contain lime and phosphoric acid in exactly the same proportions that they are required in the building up of the bones of the animals fed upon them, it would seem better to provide a food in which the proportion of lime to phosphoric acid is higher, since the object in view is to amend the too low ratio which exists in the actual food of the animal.

Practical Conclusions Deducible from the Foregoing Considerations.

1. It is unwise to feed animals upon an exclusive diet of cereals because of the ill-balanced proportions of lime and phosphoric acid

present in the ash of these plants. As already pointed out, the feeding of horses and mules entirely upon oat-hay or oat-hay and mealies, which is so commonly done in this country, involves the supply of too little lime in proportion to phosphoric acid for the requirements of the animal. In Europe, the usual plan is to employ a diet consisting largely of meadow or clover hay, and, therefore, containing a much higher ratio of lime to phosphoric acid. Lucerne, either green or as hay, will probably be the most available material in this country to correct the present diet.

Bran, which is usually regarded as valuable because of its high content of "bone-forming" material, is really not suitable for promoting bone formation unless it is supplemented by some food rich in lime. Bran contains, in each, 100 parts of dry matter, about 3.33% of phosphorus pentoxide, but only 0.30% of lime, or in the ratio of 1 : 0.09.

2. The supply of common salt is absolutely essential, and, in districts where this substance does not occur in the soil or water, it is advisable to supply it to animals in the form of "lick."

The addition of lime or of bone meal to the "lick" may also be useful, though it is probable that these substances as "lick" are not so effective as when they form actual constituents of the food plants. The same applies to sulphur, which is also often added to "licks."

It should be pointed out, however, that, in addition to supplying the physiological requirements of the animals, salt, sulphur and other additions sometimes made to the "lick," act medicinally, sometimes as vermifuges, sometimes as purgatives. This aspect of the question, however, cannot appropriately be discussed here.

SUMMARY.

Plants obtain from the soil certain mineral substances which are necessary for their growth.

In the seeds there is a concentration of some of these mineral constituents, particularly of phosphoric acid, potash and magnesia, with relatively little lime.

In the leaves and stems of certain plants, lime is, relatively to the phosphoric acid, much more abundant than in the seeds.

That cereals are remarkable for the low proportion of lime to phosphoric acid contained in both their seed and straw.

That leguminous plants, *e.g.*, lucerne, clover, peas and beans, contain a high proportion of lime in their leaves and stems.

That lime and phosphoric acid are required for the formation of bones in animals in the proportion of about 1.5 of lime to 1 of phosphoric acid, and that, in all probability, these are the proportions in which these constituents should be present in the rations of the

animals in order to give the most favourable conditions for healthy growth.

That animals require, for their proper growth, supplies of chlorides, fluorides, iron, and probably other substances which may not be present in sufficient quantity in their food.

That a diet composed exclusively of cereals, *e.g.*, oat-hay or oat-hay and mealies, is not suitable for animals, and that the preponderance of phosphoric acid in such a diet should be compensated by the addition of foods rich in lime, *e.g.*, lucerne, clover or even grasses.

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II.] NOTE ON CASTOR OIL.

BY HERBERT INGLE, B.Sc.

Much interest is being taken, just now, in this plant, so that, despite the many references to it which have appeared in the "Journal" recently, a few notes on some of the products derived from it may be of interest.

In "Die Landwirtschaftlichen Versuchs-Stationen," Band 64, Heft 1, appeared a long article on "Castor Residues" by Halenke and Kling, a brief abstract of which is the following:

The residue from the preparation of castor oil from castor seeds is usually employed as a manure. It cannot be used in its crude state as a food because it contains an excessively poisonous constituent, which, however, can be rendered harmless by suitable methods. The poison-free cake or meal then forms a useful food-stuff, being particularly rich in protein.

In Germany the product is carried by the railway at the same rates as manures, excepting in Bavaria, where the freight charged is that of oil-cakes, and about 20% higher than that of manures.

In Germany most of the castor oil is produced at Mannheim from seed imported chiefly from British and Dutch India. Only a small quantity of seed comes from other countries, chiefly from South America. The recent imports of the seed into Germany were as follow:—

	From British India. Tons.	From Dutch India. Tons.	From other countries Tons.	Total. Tons.
In 1901 ..	1,968.9	773	1.0	2,742
„ 1902 ..	2,509.3	1.2	9.9	2,520
„ 1903 ..	2,730.0	37.1	13.2	2,780
„ 1904 ..	2,757.4	128.9	28.8	2,915

The figures in the above table refer to metric tons, *i.e.*, of 1,000 kilograms or 2,205 English pounds.*

* These figures are small in comparison with the imports of castor seeds into France (practically all to Marseilles). Thus, in 1903, 27,631 tons of castor seed were imported at Marseilles (against the average of 24,671 tons of previous years). In the same year, a total of 485,544 tons of all oil-seeds, earth-nuts and coprah were imported, some of the principal

The authors then go on to say that there is little literature dealing with the methods of extracting castor oil and the preparation of the oil-cake for feeding purposes. They mention two methods for the latter object, in one "the castor meal is prepared from the seeds by a patented process by which all the oil is obtained and the meal left in a completely poison-free state. By the method of manufacture, the material is heated under high steam-pressure so that every trace of the poisonous substance is removed."

In the other method—that of Nagel—the powdered residue from the oil-press is allowed to stand in contact with six or seven times its weight of a 10% solution of common salt in the cold, with frequent agitation. The whole is then passed through a filter press and washed with salt solution until a portion of the washings gives no precipitate on heating. The meal is then removed from the filter and dried, and is then ready for use as a food-stuff. The salt solution which contains the poisonous "*ricin*," is then heated to boiling, when the ricin is precipitated, filtered off, and removed. The filtered salt solution can then be again used on a fresh portion of castor cake.

Next comes a description of the castor-oil plant, and a short history. The authors state that the castor plant, also known as the "Wonder Tree," "Palm of Christ," or "Kerva Tree," belongs to the family of Euphorbiæ, and is spread over nearly all tropical and some temperate lands. In India and Africa it becomes a tree and reaches a height of 30 or 40 feet. In the Azores and the warmer Mediterranean countries, Algiers, Egypt and Greece, it is still tree-like, but rarely exceeds 10 or 12 feet in height, while in Germany, France and the South of England it is an annual not exceeding 6 feet in height. Even in Norway it will grow, and, in warm summers, will sometimes ripen its seed.

Its original home was India.

As to its history, they state that it was known to the ancient Chinese, who used its oil in painting.

It is also mentioned by Herodotus, and in the Bible. The Hebrew word "Kikajon," which, in Jonah, Chap. IV., v. 6, is translated "gourd" in the English Bible, is said to really refer to the castor tree.

Dioscorides describes the plant under the name Croton, as being of the size of a small fig tree with leaves similar to those of a plantain, and with seeds contained in a spiny cover.

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varieties being 122,431 tons of gingelly seed from East India, 86,291 tons of decorticated earth-nut from India, 92,784 tons of undecorticated earth-nut from the West Coast of Africa, and 106,678 tons of copiah from all parts. Practically all these materials are crushed in the oil mills of Marseilles. ("Journal of the Society of Chemical Industry," 1904, p. 805).

In 1904 the total value of the oil seeds and nuts imported into France was £8,388,000; in 1905, £7,704,000. The exports were.

		In 1904.		In 1905.
Olive oil	...	£168,000	...	£324,000
Other oils	...	£920,000	...	£1,036,000
Oil cakes	...	£864,000	...	£924,000
Oil seeds and nuts		£280,000	...	£236,000

("Journal of Society of Chemical Industry," 1906, p. 1235).

About the 13th and 14th centuries castor oil appears to have been well-known and used in medicine. After this it seems to have been forgotten until 1764, when a physician of the name of Cavane, who had lived for many years in India, published a work on castor oil and its purgative properties, and in a short time it came into general use as medicine all over the world. At present, only a small proportion of the castor oil manufactured is used for medicinal purposes, the major part serving as the raw material in various chemical industries. Large quantities are employed in the manufacture of Turkey-red oil (in dyeing), for lubricating and burning purposes, and in the preparation of transparent soaps.

The authors next give a description, at some length, of the seeds and structure of the several varieties, but this cannot appropriately be abstracted here.

Chemistry of the Plant.

They then deal with the chemical composition of the seed and of its constituent parts.

The following table gives the composition of various samples of castor seeds from analyses made some years ago:—

In the original seeds.

	Water	Protein	Oil	Carbohydrates.	Fibre.	Ash.
From Texas ..	4.40	(3.79)	46.95	16.46	25.50	2.90
„ Italy ..	8.00	20.50	52.62	15.95		2.93
„ India ..	7.26	19.26	55.23	14.85		3.40
Whole seed ..	6.46	15.30	51.35	5.07	18.51	3.01
Inner kernel ..	6.46	19.24	66.03	2.91	2.47	2.89
Outer husk ..	6.46	5.79	3.22	9.15	71.10	4.28

The authors remark that the figures in the first-mentioned analysis are probably incorrect.

They next give figures derived from their own examination of the commercial Indian castor seeds.

In the sample they examined they found—

98.1 per cent of real seeds.
1.3 „ „ fragments of the outer "fruit."
0.6 „ „ small stones.

100.0

The seeds were then separated into husks and kernels. They were found to consist of—

70.22 per cent. of kernel.
29.78 „ „ husk.

These were separately analysed and gave the following figures:

	Water.	Protein.	Oil.	Carbohydrates.	Fibre.	Ash.
Kernels ..	3.60	23.43	66.02	4.01	0.70	2.24
Outer husks ..	8.76	4.76	0.98	32.92	48.69	3.89
Whole seed ..	5.14	17.88	46.65	12.61	14.99	2.73

Of the total nitrogenous substances ("protein" in above table), there were 22.62 per cent., 4.18 per cent., and 17.13 per cent., respectively of real proteid or albuminoids. In the carbohydrates, there were 0.89 per cent., 15.63 per cent., and 5.29 per cent., respectively, of pentosans.

They also give an analysis of the ash of castor seeds by Thoms (1890):—

Moisture	0.30
Insoluble matter (sand, etc.).. ..	19.59
Iron oxide	5.65
Lime	17.08
Magnesia	10.53
Potash	14.30
Soda	1.88
Phosphorus pentoxide	23.67
Sulphur trioxide	6.01
Chlorine	0.29
	99.27

Thoms points out that if the ash were obtainable in considerable quantities it might be used with advantage in the preparation of superphosphate.

They next describe the properties of castor oil. It is a very thick, colourless, or faintly yellow oil, transparent, with a mild taste and slightly rough after-taste and a faint insipid smell.

Its specific gravity is at 15° C., from 0.960 to 0.966; it solidifies at —17° or —18° C., though American castor oil becomes solid at about —10° to —12° C. It dries very slowly when exposed to air in a thin layer, and is soluble in all proportions in alcohol, ether, chloroform, benzine, or glacial acetic acid, but is insoluble in benzoline, petroleum ether, petroleum or paraffine.

The purgative effect of castor oil is strongest in samples extracted by the aid of carbon disulphide, and is more pronounced in oil expressed from the whole seed than in that from the decorticated seed. It is weakened by the heating of the oil.

Castor Cake.

The authors next deal with the main object of their paper—the properties, composition and uses of the castor cake, *i.e.*, the residue left after the removal of the oil from the seeds.

According to Voelcker, the castor cake from decorticated seed contains—

8.69% of nitrogen.
=54.3% of crude protein.

Another analysis by Kellner, of poison-free castor cake (dried) gave—

Crude protein	34.01
Oil	1.17
Fibre	41.00
Carbohydrates	15.27
Ash	8.55
	99.99

Another analysis gave—

Crude protein	31.57
Oil	1.23
Carbohydrates	10.91
Fibre	39.19

They next give analyses of raw castor cake from Mannheim made by themselves. The means of the figures for two samples give—

Moisture	12.11
Crude protein	28.76
Oil	4.06
Carbohydrates	18.63
Fibre	30.69
Ash	5.77
	100.02

The ash contained—

Silica, etc.	1.19
Phosphoric acid	1.59
Potash	1.07

They also refer to many other determinations of the manurial constituents of castor cake in which the proportion of nitrogen varies from 1.61 to 7.68%, of phosphoric acid from 0.28 to 2.06%, and of potash from 0.70 to 1.53% of the whole cake. They attribute these great variations to the greater or less proportion of the husk parts of the seed contained in the cake.

The Poison of Castor Seeds.

They next discuss the poisonous constituent of castor seeds.

According to Stillmark (1890), this is a substance called "Ricin," or "Rizin," which is not an alkaloid but an albuminoid body—a so-called Phytalbumose, and belongs to the class of unorganised ferments. It can be extracted from the castor cake by a 10% solution of common salt. From this solution it can be precipitated by magnesium and sodium sulphate.

When purified, as far as possible, it is a white powder possessed

of remarkable poisonous qualities—0.03 millogramme per kilogram of body weight is sufficient to kill a dog.

Moreover, since according to present knowledge it cannot be detected in corpses, it is one of the most dangerous poisons from the standpoint of forensic medicine.

Ricin is absolutely tasteless, and loses its poisonous quality almost instantaneously by boiling.

Ehrlich discovered (1891) that animals could be made immune against large doses of the poison contained in castor seeds, and that the serum derived from immunised animals contained a specific antitoxin. Mice, rabbits, goats, and also the higher domestic animals can thus be immunised. The immunity can be made so complete that many hundred times the fatal dose may be administered to animals without any reaction, and 1 cc. of their serum will entirely neutralise many such doses.

The poison has long been considered a single substance, but Cushny and Muller have shown (1898 and 1899) that Ricin consists of two poisons—a *toxin* and an *agglutinin*. The latter acts upon the red corpuscles of the blood and causes them to agglutinate.

Earlier investigators, *e.g.*, Tuson (1864) and Soave (1895) ascribe the poisonous qualities of castor seeds to a crystallizable substance which they call "Ricinin," and which they found to the extent of 0.03% in decorticated pressed seed, and to 0.15% in the husks. It was extracted by boiling water, and had a composition corresponding to the formula, $C_{17}\ H_{18}\ N_4\ O_4$ and had not the properties of an alkaloid.

The authors, however, do not believe that Ricinin is the poisonous constituent of castor beans. Another view (Benecke, 1885) ascribes the poisonous quality of castor cake to a branching fungus which readily grows upon it.

As to the place in the seeds where the poison occurs, authorities differ greatly. Stillmark thinks it occurs in the embryo and in the endosperm, and not in the husk. Cornevin states that it occurs in all parts of the plant, but to the largest extent in the seed.

The action of the poisonous constituent of castor seeds upon different domestic animals has been studied by Cornevin. The resistance to the poison is very different with different animals, rabbits being extremely sensitive, while fowls are very resistant. Thus to kill he found there were required—

With	rabbits	2	grammes of	seeds	for each	kilogram	body weight.
,,	sheep	2.5	,,	,,	,,	,,	,,
,,	oxen	3.0	,,	,,	,,	,,	,,
,,	horses	3.0	,,	,,	,,	,,	,,
,,	dogs	3.5	,,	,,	,,	,,	,,
,,	pigs	5.6	,,	,,	,,	,,	,,
,,	hens	40.0	,,	,,	,,	,,	,,

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„	sheep	2.5	„	„	„	„	„	„
„	oxen	3.0	„	„	„	„	„	„
„	horses	3.0	„	„	„	„	„	„
„	dogs	3.5	„	„	„	„	„	„
„	pigs	5.6	„	„	„	„	„	„
„	hens	40.0	„	„	„	„	„	„

Bugge (1905) found that one seed (weighing about 0.2 gramme) was sufficient to kill a young pig, which died five days after taking it, and, in another case, two seeds caused death after three days.

According to Cornevin, a characteristic symptom of castor poisoning is the long interval between the administration of the poison and the appearance of its effects—10 or 12 hours, or, with poultry, even 48 hours. Other symptoms are drowsiness, rise of temperature, feverish pulse and distaste for food.

When castor cake is employed as manure, Cornevin recommends that stock be kept off the land for at least twelve days after the manuring. After that period, the poisonous constituent is destroyed. No injury to seedlings in the soil need be feared.

Castor Cake as a Food-stuff.

After treatment with high pressure steam, the poison in castor cake is rendered perfectly harmless so that the prepared material may safely be used as a food for animals. As the exclusive food, however, castor cake alone is not to be recommended, as it is not, under such circumstances, very digestible, besides being too rich in protein, but, mixed with potatoes, mealies, etc., it can be used in large quantities without injury. Animals so fed thrive well.

Cornevin also recommends the crude castor cake as a food for animals previously immunised against the poison.

Immunisation can be effected by feeding the animals with small quantities of the crude cake so that they gradually become accustomed to the poison when serum taken from such animals can be used to immunise others. Or the castor cake can be digested with 10% solution of common salt, filtered, and the filtrate boiled for two hours. The solution injected under the skin of an animal confers immunity, and the green plant, the seed or the castor cake may then be administered to the animal without the slightest injury. Once immunised, animals remain unaffected by the poison for a long time. The flesh of immunised animals is not affected, and affords perfectly satisfactory meat.

Experiments on the digestibility of castor cake show the protein in it to be well digested, but give somewhat low figures for the carbohydrates and fibre. Better results would, doubtless, be shown with the decorticated castor cake.

For milch cows, the results obtained in 1900 at Popplesdorf (Bonn) were not very satisfactory. Castor cake, apparently, was far inferior to the other food-stuffs with which it was compared, which included earth-nut cake, palm-nut cake, linseed meal, etc., as the yield of milk, the percentage of fat and the quality of the butter were all diminished.

It is not, therefore, a suitable food for milch cows. The farmer who wishes to use the prepared castor cake as a food should first test its harmlessness upon small animals before giving it to large and valuable ones.

Adulteration of other Feeding Cakes with Castor Cake.

This is very dangerous, and has often led to injury and death of valuable animals.

It generally arises from carelessness in the oil mills, whereby linseed, cotton seed earth-nut, or other oil-bearing material is crushed in presses which have not been completely cleansed from castor residues from previous operations. A very small admixture of ordinary castor residues is sufficient to render other oil cakes dangerous as food-stuffs.

The detection of such small adulteration is difficult, and often depends largely upon microscopic examination whereby certain characteristic structures of the castor seed may be identified.

* * * *

III.]

NOTES FROM THE CHEMICAL LABORATORIES.

The following notes of some of the substances examined in the Laboratories during the past few weeks may be of interest:—

Cocoa-nut Cake.

A sample of this material, obtained from Durban, was analysed and gave the following figures—for comparison I give the average composition of cocoa-nut cake and of "old process" linseed cake from American analyses:—

	Cocoa-nut Cake. A. Durban.	Cocoa-nut Cake. B. Av. American.	Linseed Cake. Av. American.
Moisture	14.97	10.3	9.2
Ash	8.82	5.9	5.7
Protein	22.63	19.7	32.9
Oil	8.05	11.0	7.9
Carbohydrates	45.53 (Carbohydrates and Crude fibre)	38.7	35.4
Crude fibre		14.4	8.9
	100.00	100.0	100.0

The figures show the Durban sample to be higher in moisture, protein, and ash than the average of the American samples, though poorer in oil.

It was proposed by my correspondent to use the cocoa-nut cake as part of the rations for horses instead of linseed cake, of which he informs me, he could not get the animals to eat more than about 1 lb. per day each. The cocoa-nut cake, though much poorer in protein than the linseed, will probably prove more palatable and better suited for horses. Investigations with French army horses about 1883, indeed, proved that cocoa-nut cake was superior in feeding value to an equal weight of oats, and their substitution for oats, at prices

ruling at the time, would lead to a saving of about £2 per year in the cost of keeping an army horse.

GROUND-NUT CAKE.

A sample of this material, also from Durban, has been examined and yielded the following results—the average of American analyses of the product is also given for comparison:—

	Durban Sample.	Average American.
Moisture	10.95	10.7
Ash	5.16	4.9
Protein	45.00	47.6
Oil	7.64	8.0
Carbohydrates } ..	31.25	23.7
Fibre .. }		5.1
	100.00	100.0

The Durban sample agrees very well in composition with the average American one, but is not quite so rich in protein.

In using a food so rich in protein as ground-nut cake, it is necessary to feed it in small quantities, or digestive troubles may ensue.

The albuminoid ratio of the two cakes would be (assuming that all the constituents have the same digestion coefficient, which is not necessarily the case):

$$\text{Cocoa-nut cake } \frac{22.65}{45.53 + (8.05 \times 2.3)} = \frac{22.65}{64.04} = \frac{1}{2.82} = 1 : 2.82$$

$$\text{Ground-nut cake } \frac{45.00}{31.25 + (7.64 \times 2.3)} = \frac{45.0}{48.82} = \frac{1}{1.085} = 1 : 1.08$$

Both these foods, therefore, require to be mixed with considerable quantities of starchy foods in order to form a ration with an albuminoid ratio of about 1 : 5, which is probably best for hard-worked horses.

The money value of the two foods, adopting the rough method of calculation described on pp. 818 and 819, Vol. IV., No. 16, of this "Journal" would be:—

For cocoa-nut cake:

Carbohydrates and fibre, 45.5 @ 2s. ..	91.0
Protein, 22.63 @ 5s.	113.15
Fat, 8.05 @ 5s.	40.25
	244.40

i.e., £12 4s. 5d. per short ton.

For ground-nut cake:

Carbohydrates and fibre, 31.25 @ 2s. ..	62.5
Protein, 45.00 @ 5s.	225.0
Fat, 7.64 @ 5s.	38.2
	325.7

= £16 5s. 8d. per short ton.

These figures are, undoubtedly, too high because, in the above calculation, we have assumed all the constituents to be digestible, which is not the case, particularly with the "fibre."

Iron in Soils.

Certain correspondents are apparently anxious as to whether the presence of too large a quantity of iron compounds in their soils may have an injurious effect upon crops. Now, in the rocks from which soils are formed, iron exists in two states of combination—as *ferrous* compounds, in which iron is *divalent*, *i.e.*, capable of replacing two atoms of hydrogen; and as *ferric* compounds, in which iron is *trivalent*, *i.e.*, capable of replacing three atoms of hydrogen. A compound of the former class is ferrous oxide, which has the composition expressed by the formula FeO, *i.e.*, contains one atom or 56 parts by weight of iron, to one atom or 16 parts by weight of oxygen. As a type of ferric compounds, ferric oxide may be taken; this has the composition Fe_2O_3, *i.e.*, two atoms of iron or 112 parts by weight united with 3 atoms or 48 parts by weight of oxygen.

Compounds of ferrous iron are white or greenish in colour, those of ferric iron are red or yellow.

The former, on exposure to air, absorb oxygen and pass into the latter. This is often apparent by a change in colour—many rocks when freshly quarried are green or blueish grey in colour, but, on exposure to air, gradually become red or yellow. This change in colour is due to the conversion of the ferrous compounds present in the original rock into ferric compounds, and is brought about by absorption of oxygen from the atmosphere.

Ferrous compounds, particularly if soluble in water, are very injurious to plants, and their presence in a soil in any quantity unfits it for supporting plant life.

Fortunately, the conversion of ferrous into ferric compounds by absorption of oxygen from the air takes place with great readiness; consequently, in the weathering of a rock into small fragments, which occurs in the formation of a soil, there is, in my opinion, little danger of the ferrous compounds originally present in the rock persisting; they must almost inevitably be converted into ferric salts and thus rendered harmless to plants.

In some shales, iron pyrites, FeS_2, may be present, and, although this is a ferric compound, it is readily oxidised in the presence of air and moisture, forming ferrous sulphate and sulphuric acid. Both these compounds are very injurious to plants, and, if present in soils, render them sterile. Some soils are thus injured owing to the presence in the soil of fragments of shale, in the interior of which unoxidised iron pyrites may exist, and, by slow oxidation, provide a slow supply of the injurious compounds just mentioned.

But there is another cause which results in the formation of these harmful ferrous salts in a soil. If a soil be rich in ferric salts and be so situated that large quantities of organic matter accumulate in it —as may happen in the case of a vlei or marsh—then the access of air is prevented and the decaying vegetable matter will remove oxygen from the ferric oxide and reduce it to ferrous oxide, which, as soon as it is formed, is converted by the carbon dioxide, produced by the decay of the organic matter, into ferrous carbonate. This is then dissolved in the water of the soil by the aid of further quantities of carbon dioxide, and the soil in its lower portions becomes permeated by a solution of bicarbonate of iron which renders it totally unfit to support plant life.

In some cases, the dissolved ferrous carbonate may be deposited again and cement the fragments of the soil together in the form of a hard impervious crust known as an "iron pan," thus rendering the soil still less fitted for plants. Probably the production of "ou'klip" in this country is due to a similar cause.

We have recently examined several soils and sub-soils down to a depth of six feet with a view to ascertaining whether they were suited for lucerne cultivation.

In several instances we have been able to detect the presence of small quantities of ferrous compounds near the surface—in the first and second foot, while, deeper down, all the iron was in the ferric condition. In one case, a reef containing magnetite (which is essentially Fe_3O_4 or Fe_2O_3. FeO, and therefore, contains ferrous iron) ran across the land, and, in samples taken near the reef, large quantities of ferrous iron were found, while further away less and less of this substance occurred.

We may probably safely assume that a soil containing any appreciable quantity of ferrous compounds is not suited for lucerne or other ordinary farm crop, while the presence of considerable quantities of iron in the ferric state is not objectionable.

The remedy to be applied to soils containing ferrous compounds consists in repeated cultivation so as to admit air and the addition of lime.

Tillage, *i.e.*, ploughing, harrowing, etc., is, indeed, a remedy for most evils in soils, for the free aeration tends to remove ferrous compounds, to destroy objectionable vegetable acids, and to render

more available the potash, phosphoric acid, and other plant food which the soil may contain.

SUMMARY.

Ferric compounds in a soil are not objectionable (unless, perhaps, in very excessive amount), but ferrous compounds (or any conditions favourable to the formation of ferrous compounds) are very injurious to plant life.

In order to prevent the occurrence of ferrous compounds, the best methods are repeated stirring of the soil and the addition of lime to it. These methods are also beneficial to the soil in other respects.

THE VETERINARY SECTION.

GLANDERS—ITS ERADICATION.

By J. M. Christy, Ass. P.V.S.

Glanders has been described by one of the Johannesburg daily papers as a loathsome disease, and it has been pointed out that it is communicable to the human subject. Both of these statements are correct, and I might add that no case of recovery from glanders in the human subject has ever been placed on record, so far as I am aware, and the best authorities are sceptical as to whether an equine once infected with glanders ever recovers, or that it would be safe to allow such an animal to come in contact with other healthy animals capable of contracting the disease.

It might be useful here to state that glanders is a specific communicable disease, due to the *bacillus mallei*, and chiefly affecting horses, mules and donkeys, though capable also of affecting human beings. In view of these facts glanders must be looked upon as a virulent disease, desirable of eradication if it is humanly possible to do so. Can glanders be got rid of? The answer is emphatically, Yes. The answer as to whether it is desirable and necessary to get rid of it remains with the people. Why do we say that glanders can be got rid of? Because we know that it is caused by a living organism that can, practically speaking, only exist and reproduce itself in living animals, chiefly equines. The solution of the matter is merely a question of procedure and finance, legally enforced. To get rid of glanders you have only to destroy every animal affected with the disease, namely those visibly sick to the ordinary observer, and those with the infection of the disease in their systems, animals presenting no indications to the ordinary observer, capable of doing their ordinary work—possibly under favourable conditions improving in appearance and putting on condition, still diseased and capable of transmitting the disease—in other words, apparently perfectly healthy animals that react to the mallein test.

The following extract from the report by Mr. J. G. Rutherford, Veterinary Director General to the Canadian Department of Agriculture, will serve to illustrate what the Canadian Government are prepared to do in this matter:—

> "Since the discovery of mallein, in 1890, a complete change, due to the information acquired through its use, has taken place in the views held by modern veterinarians regarding glanders. It is now definitely known that many horses are affected while, for the time being, presenting no apparent symptoms, the

disease being confined to the internal organs of which the lungs are most generally involved. This being so, it goes without saying that the method formerly followed in dealing with glanders and still in vogue in some countries, namely, the slaughter of horses showing clinical symptoms only, is entirely inadequate. Experience has shown that where one or more clinical cases are found in a stable it is almost a certainty that some of the animals have been directly or indirectly in contact with them are also affected. Of these many, sooner or later, develop clinical symptoms, and so become active centres of infection, while there is good ground for belief that the disease can be communicated by animals showing no external evidence of its existence. It follows, therefore, that any system which neglects these contact cases is defective, and certain to result in spreading the disease, especially in view of the perhaps natural tendency shown by owners to dispose, as soon as possible, of any animals left in their possession after the destruction of those visibly affected.

"Where no compensation is paid for horses slaughtered, the inspector dealing with an outbreak of glanders finds himself in a very difficult position. Owners possessed of any intelligence seldom object to the slaughter of animals evidently diseased, but are naturally opposed to the killing of those which, while reacting to mallein, remain in good condition, and are, so far as they see, perfectly healthy. The tendency therefore is to refrain from testing contact horses on the theory that 'ignorance is bliss,' for if tested and found to react they must be dealt with as diseased, while if presumed to be healthy they may be left free from restrictions. The results of such an ostrich-like policy are, however, bound to be eventually disastrous, as may be seen from the following figures taken from the returns of the Board of Agriculture, which show the number of horses slaughtered for glanders in Great Britain under this system from 1898 to 1904 inclusive:—

1898	1385
1899	1472
1900	1858
1901	2370
1902	2073
1903	2499
1904	2628

"The steady progress made by the disease under a similar policy as evidenced by the experience of Manitoba and other infected districts, furnishes additional convincing proof of the folly of ignoring the constant and very real danger

connected with the contact horse, even when he is absolutely free from visible symptoms of glanders.

"It is known that a proportion of such horses as react to mallein when first tested, subsequently cease to show even that evidence of disease, having, to all appearance, overcome the infection. Beginning in 1902, it was decided, in default of compensation, to institute a system of carefully testing all contact horses, and subsequently retesting such as reacted, with a view to releasing those ceasing to react at the second or third test, and destroying those in which the reaction persisted.

"In my reports for the years 1903 and 1904 may be seen a complete record of the work done in carrying out this policy of retesting which taxed the energies of our officers to the utmost. The results achieved, while showing a great improvement on the old methods, were in no degree commensurate with the risk and labour inseparable from such a policy, especially in the newer and more sparsely settled portions of the Dominion.

"After a trial extending as above indicated over two years this system was found to be unworkable and far from satisfactory, inasmuch as it was shown to be practically impossible to keep reacting horses under such close observation as might offer comparative freedom from the risk of spreading infection. Among groups of reactors held for further tests, one or more are likely to develop clinical symptoms, thus becoming virulent centres of infection, not only endangering other reactors with which they are in actual contact, they being in no way immune from infection, but through the various indirect channels with which horsemen are familiar, threatening the health of other animals not actually housed with them. More recently frequent proofs have been furnished that many of the so-called ceased reactors can be by no means looked upon as permanently cured. Several serious outbreaks can be traced directly to such horses, and, making due allowance for the possibility of reinfection from outside sources, I may say that I am in possession of what I consider to be indisputable evidence in confirmation of the view that these animals are exceedingly dangerous. The risk attending their release is greatly increased by the tendency almost invariably shown by owners to dispose of them at the first available opportunity, when, falling into the hands of unsuspecting persons, they frequently introduce the disease among their new stable companions.

"The policy of retesting reactors having thus been fairly tried and found wanting, while that of slaughtering clinical cases and ignoring contact horses had proved worse

than useless, there remained the alternatives of leaving the disease alone to spread as opportunity offered, or of applying the only practical, and at the same time the only scientific, remedy, namely, the destruction of all horses giving typical mallein reaction whether presenting any external manifestations of glanders or not.

"Having decided on the latter course, you obtained from the Parliament during the session of 1904 the necessary authority by an amendment to the Animals Contagious Diseases Act, and at the same time secured the increased appropriation required for purposes of compensation. This was fixed by the Act at two-thirds of the actual value of the animal in a state of health, such value being limited in the case of ordinary horses to 150 dollars (£30), and in the case of pure-bred horses to 300 dollars (£60).

"On the principle that a horse showing clinical symptoms of glanders is not only absolutely valueless, but is a constant source of danger to all other horses as well as to its owner, his family, and any other human beings who may directly or indirectly be exposed to the contagion, it was at first decided to pay no compensation for cases of this class. The Order in Council of September 19, 1904, which brought the new policy into force therefore contained a provision to that effect. It was soon apparent, however, that in order to secure early information as to the existence of glanders, and to enable our inspectors to carry out the law without undue and dangerous friction, it would be necessary to amend the regulations so as to permit of the payment of compensation of all animals slaughtered in accordance with the Act.

"This was accordingly done, and on March 25, 1905, the following regulations were put in force :—

'*By Order in Council, dated 25th March, 1905, in virtue of The Animal Contagious Diseases Act, 1903.*

'4. Veterinary inspectors are hereby authorised to inspect and to subject to the mallein test any horses, mules or asses affected with glanders or suspected of being so affected, or which have been in any way whatsoever exposed to the contagion or infection of the disease of glanders, and for the purpose of making such inspection or test to order any such animals to be collected, detained or isolated.

'5. Horses, mules or asses affected with glanders, whether such animals show clinical symptoms of the disease, or react to the mallein test without showing such symptoms, shall, on an order signed by a duly appointed inspector of the Department of Agriculture, be forthwith

slaughtered and the carcase disposed of as in such order prescribed, compensation to be paid to the owners of such animals if and when the Act so provides.'

"Since the policy of compensation was adopted many outbreaks have been reported and dealt with by our inspectors. Some of these occurred in parts of the Dominion where, so far as the Department was concerned, the existence of the disease had not previously been suspected.

"There is no doubt that, so long as the policy of slaughter without compensation was in force, the tendency of owners, and even of some veterinarians, was to conceal the existence of glanders and to dispose of the suspected animals as quickly as possible.

"On the other hand it can be readily understood that the adoption of a policy of paying for slaughtered animals has encouraged owners and veterinarians to report much more freely the existence of the disease.

"So far as it is possible to judge at this comparatively early date after its adoption, the new policy is likely to prove successful in securing the object sought, namely, the complete eradication of glanders. In those districts where the disease has been prevalent, and where people have for many years been heavy losers from its effects, the new regulations are giving great satisfaction, and intelligent horse-owners freely express their approval of the change."

Let me also add that with a view to the eradication of glanders in London, according to the "Daily Mail,"

"The Government at last have agreed to contribute to the compensation which will be paid to horse-owners for the stamping out of glanders. This is good news, because the item of compensation has long been a stumbling block to any course which would secure the co-operation of the horse-owner. No other disease of animals has ever been the object of legislative control without provision for the in-contact animal, and valuable horses naturally could not be slaughtered without compensation. When fair compensation is given for the slaughter of in-contact horses there is nothing to prevent the extermination of glanders. Slaughter of reactors to mallein will have a great effect upon the disease, but payment to the owner of compensation will effect the necessary co-operation of all concerned. We believe the money from the Treasury to assist local authorities will be available after the end of March, and then a real attempt at extermination of the disease will commence."

In the Transvaal we can pay compensation for reactors to mallein under certain circumstances. The attention of the public is called to

the information and to the conditions under which such compensation will be paid, which are embodied in the warning appearing in Departmental Notices of the current issue, as well as in the second article in this section.

* * * *

SOME NOTES ON THE PREVALENCE OF THE DIFFERENT CONTAGIOUS DISEASES AT PRESENT EXISTING IN THE TRANSVAAL.

By Rodney H. Williams.

East Coast Fever.

This disease, which is more generally known by the name "Rhodesian Redwater," is now well in hand, and the Veterinary Division have every hope of stamping it out of the Transvaal completely in the near future. The command that the Veterinary Division has obtained over the disease must be attributed to two things : (1) the permit system, somewhat irksome to the farming community but admittedly the chief factor in checking the spread of and eventually stamping out East Coast fever ; (2) the fencing-in of infected and suspected farms, which is going on steadily. At the present moment the disease is rifest in the Zoutpansberg district ; this is probably due, in a large measure, to the illegal movement of infected cattle by the natives.

A number of special native constables have been enrolled to check these movements, but owing to the vast extent of the Zoutpansberg district the natives probably manage to elude the police by moving their cattle at night. The possibility of carrying out such illicit movements will be greatly reduced when the branding of the native cattle now under contemplation has been carried out in the Zoutpansberg district as it has already been done in Barberton ; the latter district, which at one time was full of the disease, now being almost clean. Secoeconiland, in the Lydenburg district, another native territory, has been completely fenced in, 200 miles of fencing, and a special fence guard has been appointed, whose sole duty is to patrol the fence and repair it when necessary. A temperature camp has also been started there.

Though there are a great number of farms in quarantine in the Piet Retief district, the Veterinary Division have the disease well in hand in that section, and fencing is being done on a large scale.

Several farms in the Middelburg district have lately been taken out of quarantine, and a good many more will probably be liberated before long. It is very gratifying to see ox transport once more on the Market Square in Pretoria, it is quite like old times, and it can safely be stated that had there been no regulations drawn up to control

the movements of stock, no oxen would have been seen on the square to-day.

During the past six months, viz., July to December, 1906, the following fresh outbreaks have occurred :—Waterberg (1), Barberton (3), Zoutpansberg (21), Ermelo (1), Lydenburg (1), Middelburg (6), Piet Retief (1), a total of 34, as compared with a total of 45 during the same six months of 1905.

Lung Sickness.

This disease is practically non-existent in the Transvaal, only three outbreaks having occurred during the past six months in the Middelburg, Wolmaransstad and Marico districts ; the outbreak at Wolmaransstad was the revival of an old outbreak.

Scab.

Looking at the statistics, this disease appears to be increasing. This is not the case, and is explained by two things ; firstly, that the smaller farmers are more alive to the fact that it is the best policy to protect their stock by reporting the existence of the disease, and taking steps to get rid of it by nipping it in the bud ; secondly, that the veterinary staff, now that they have the East Coast fever well in hand, have more time at their disposal to continue their campaign against scab. Our staff of inspectors has also been increased for this purpose. Government Notice 1338 of 1906 provides for compulsory dipping of all sheep and goats between the 15th March and 30th April. Copies of this notice in Dutch or English can be obtained from the Resident Magistrate or Government Veterinary Surgeon of each district on application.

We are protected from the further introduction of animals affected with scab by the establishment of the Ports of Entry on our border, therefore with the co-operation of the farmers, it should not be difficult to get the upper hand of the scab that is in the Transvaal, but without this co-operation the task before the Veterinary Division is indeed a hard one. The fencing-in of farms will be a great help in stamping out scab, as it will protect farmers from the straying of infected stock.

During the past six months 621 outbreaks of scab have been reported and attended to ; the disease is prevalent in every sheep-raising district in the Transvaal.

Glanders.

During the past six months 62 outbreaks of the above-mentioned disease have been investigated, with the result that 107 equines have died or been destroyed, and 3,301 contacts have been put through the mallein test. These statistics include the result of the outbreak of glanders which occurred in the Johannesburg Municipality stables ;

the Principal Veterinary Surgeon's report on this outbreak has already been published.

A scheme for compensation under certain conditions for glandered equines destroyed by order of the Principal Veterinary Surgeon has been approved, and a sum of money voted ; with this to back them up the Veterinary Division will make great headway towards the extinction of glanders from the Transvaal.

The great drawback to the efforts of the Veterinary Division to extirpate glanders has been the natural disinclination on the part of the horse dealer to report the existence of glanders in his stable, as there was always the chance that the remainder of his apparently healthy animals might react to the test and be ordered to be destroyed, and thereby lose his only means of livelihood.

Government Notice 103 of 1907, which is quoted below, should do away with this disinclination to a great extent :—

"It is hereby notified for public information that compensation will be paid for visibly healthy equines which, when the mallein test is applied to them by an authorised person of the Agricultural Department, react to such test, and are afterwards destroyed by order of the Principal Veterinary Surgeon in consequence of their having so reacted. Provided that :

"(*a*) The owner or custodian of any such reacting animal has given notice in writing, before the premises on which the animal is located are visited by an officer of the Agricultural Department, to the Government Veterinary Surgeon of the district, that he suspects such animal to be infected with glanders ; and

"(*b*) Such Government Veterinary Surgeon has certified to the fact and date of such notice ; and

"(*c*) Such animal has not at any time shown outward signs of being infected with glanders.

"No compensation will be paid on a greater scale than two-thirds of the value of the animal destroyed, and in no case will a greater sum than £20 be paid for any animal destroyed as aforesaid. The value of any animal destroyed will be determined by the Principal Veterinary Surgeon.

"Compensation will not be paid for any animals showing any clinical indication of glanders which are ordered to be destroyed by the Principal Veterinary Surgeon, or by any person acting on his instructions, nor for any reacting animal ordered to be destroyed in respect of which the above conditions are not complied with.

"(Signed) ADAM JAMESON,
"*Commissioner of Lands.*

"Office of the Commissioner of Lands,
"Pretoria, 24th January, 1907."

Ulcerative Lymphangitis.

During the past six months 25 outbreaks of ulcerative lymphangitis have been investigated, resulting in six animals being destroyed as incurable, and 25 animals being put under treatment. These statistics, when compared with those for the same period of the three previous years, show a steady decrease.

Mange.

This disease, which was spread all over the Transvaal during the war, is now very rare, only five outbreaks having occurred during the past six months.

Tuberculosis.

Two outbreaks has been the extent of this disease during the past six months—two animals were destroyed, and 25 tested with tuberculin with negative results.

Anthrax.

At the time of writing there are no outbreaks of this disease in existence, yet it would be hardly safe to state that the Transvaal is entirely free of anthrax. During the past six months five outbreaks have occurred, resulting in the death of eight animals.

Swine Fever.

This disease broke out in epidemic form in the Witwatersrand district, and that area was declared as infected with the disease, and no movements into or out of it were allowed without special permit. The outbreak, however, was soon under control, and as no fresh outbreaks have occurred for some time, the quarantine has been raised and free movement of pigs is allowed. During the period for which these notes are drawn up, 14 outbreaks of swine fever were reported and 154 pigs died or were destroyed. The majority of these outbreaks occurred in the Witwatersrand district. Isolated outbreaks, which were traced back to Johannesburg, appeared in the districts of Standerton, Rustenburg and Zoutpansberg.

THE BOTANICAL SECTION.

No. 1.]

DODDER IN LUCERNE.

By Joseph Burtt-Davy, F.L.S.,
Government Agrostologist and Botanist.

In the *Annual Report* of this Department for 1904-5, p. 275, I recorded an outbreak of dodder on a lucerne stand in the Pretoria district. Since then a correspondent at Christiana has reported its occurrence there, and adds: "We shall be glad to hear from you regarding methods of extermination, and should also be pleased if you will bring the existence of this pest to the knowledge of the Government, with a view to legislation on the subject, as to our mind it seems that this parasite is equally dangerous to our agricultural welfare as the *Xanthium spinosum*, if not more so." Other outbreaks have been reported from Potchefstroom and Ermelo.

In all these cases the seed is said to have come from Cape Colony; whether this was Oudtshoorn seed, or not, our informants have not stated.

As I have frequently pointed out to farmers, both in conversation and by notes in the "Journal," a good stand of lucerne is such a profitable crop, and adds so much to the value of the farm, that it pays to take more than ordinary trouble and expense to lay it down well; it saves time and money in the end; the best stands cannot be secured with poor seed, containing dodder and other noxious weeds.

The best seed we have had has been grown in Provence, France, and along the Hunter River, New South Wales. Both strains are more expensive than American or Cape Colony seed, but both of the latter are often so badly cleaned and are so unreliable that it is unsafe to use them unless they have been reliably tested and guaranteed for purity. We have bought some excellent samples of Oudtshoorn seed, and have seen many more that we would not buy at any price. Some of the most enterprising of our Colonial farmers tell us that they would rather pay 2d. per lb. more for the best re-sifted, dodder-free seed from Europe than take chances with Cape seed, on account of its bad reputation.

This is a matter much to be regretted, for with the reduction in demand for Colonial lucerne hay which must inevitably follow the increased acreage in the Transvaal, Cape Colony growers might offset the lower price of hay by selling their seed to Transvaal growers; if we could obtain good Cape seed of reliable quality and guaranteed purity we should prefer to take it. The remedy lies in the hands of Cape farmers and dealers. If some enterprising Farmers' Association or individual dealer would buy up the best local seed from fields known

to them by personal inspection to be absolutely free from dodder, and pass it all through a thoroughly up-to-date seed-cleaning plant with silk sieves, such as are used by the best European firms, in order to remove all seeds of noxious weeds, such as at present abound in Cape Colony seed, and all immature or poorly filled seeds, there is no reason why their product should not be equal to that now supplied to us from Europe. Though, as already stated, we have had several outbreaks of dodder from Cape Colony seed, not one has come to our notice from Provence seed, obtained from reliable firms, although fully 20 tons of this seed have been imported into the Transvaal within the last three years.

Cape Colony farmers accuse us of failure to encourage home industries, and of opposition to their interests ; but we must naturally look first to the interests of our own farmers. We have done what we could to induce Cape growers, in their own interest, to supply our market, by securing samples from the leading growers, and making complaint as to the quality and purity of the seed to the Oudtshoorn Farmers and Fruit Growers' Association. This complaint was laid before a meeting of that Association and considered, and some action was taken in the matter ; dodder has been proclaimed a noxious weed in Oudtshoorn Division ; the Divisional Council has employed dodder inspectors to visit the farms of growers, and it is intimated that the Council intends to "take legal steps against those who are not *doing their best* to eradicate dodder" (the italics are mine). This is good as far as it goes, but it does not go far enough to protect the Transvaal farmer or make it safe for him to buy Oudtshoorn seed without a *reliable guarantee* that it is free from dodder and other noxious weeds. It is evident from the inspectors' reports that there is still a great deal of dodder in the Oudtshoorn district ; some farmers have even adopted the attitude that they have "done all in their power to eradicate it, but without success." But if the Oudtshoorn farmers will co-operate on the lines suggested above, and furnish the Association's guarantee with every lot of seed sold by them, it is probable that the Transvaal would take 20,000 lbs. and over of their seed every year, and the amount would doubtless increase.

With the enormous increase in the lucerne acreage of the Transvaal, and the demand for "cheap" seed, it is a foregone conclusion that yet more dodder will be brought into this Colony. "Cheap" lucerne seed, whether Colonial grown or imported, is almost certain either to contain seed of dodder or other troublesome weeds, or to be immature or otherwise poor in quality. With the present demand, good, well-filled and clean seed can always command a fair price, and it is noticeable that the price in Europe is rising steadily. Good seed, well ripened, if properly selected from guaranteed dodder-free fields, properly screened and specially re-sifted through silk sieves, must necessarily cost more than immature, badly screened seed carrying no reliable guarantee.

At present the wholesale price in Europe ranges from 60s. to 72s.

Plate CLXXXII.

Dodder (*Cuscuta trifolii*, Bab.) on Lucerne Plant.

A most dangerous pest in Lucerne fields.

a Seed of Dodder, enlarged.
b Seed of Lucerne, enlarged
c Seed of Dodder, natural size.
d Seed of Lucerne, natural size.

Plate CLXXXIII

Cracking of Apples due to Fungus.

Coniothecium chomatosporum

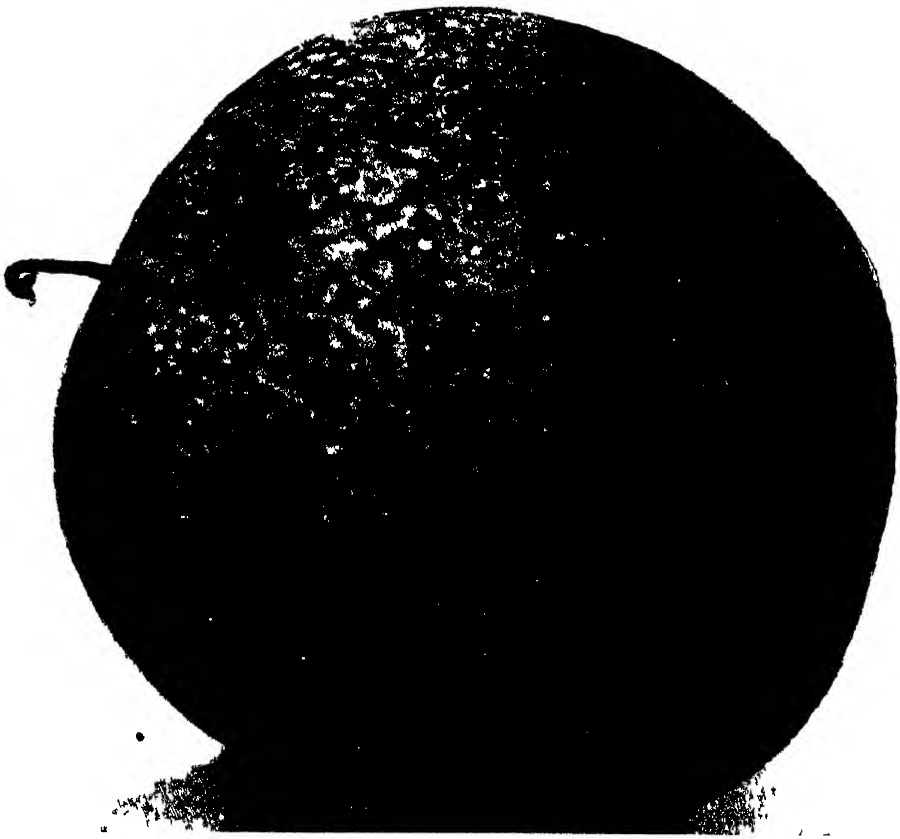

Plate CLXXXII.

Anthracnose of Water Melon.

(*Colletotrichum lagenarium*, *Pass.* Hals.)

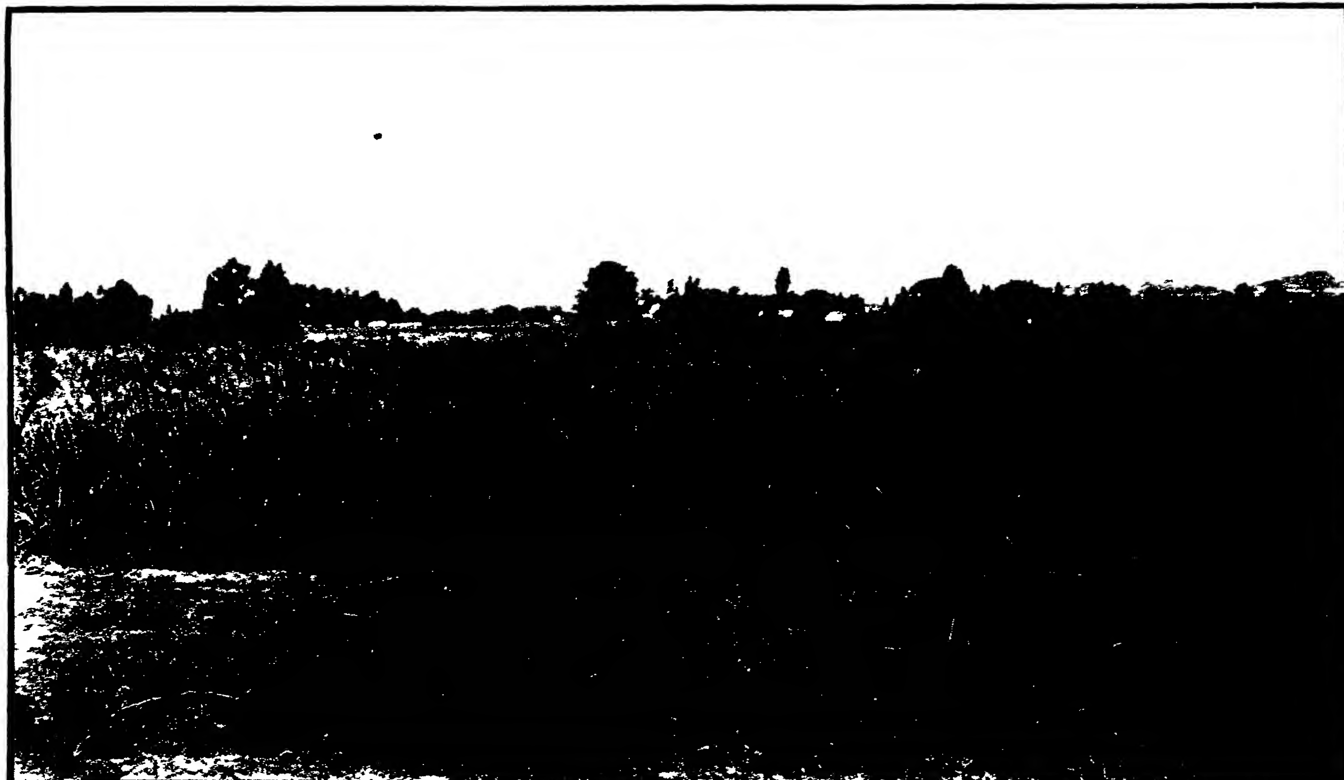

Plate CLXXXVI

Rhodes Grass.

(*Chloris gayana*)

Probably our heaviest yielding native hay grass (Botanical Experiment Station Pretoria.)

Plate CLXXVII

Soy Bean.
(*Glycine hispida.*)
A grand leguminous crop for either ensilage or green manuring. In America the beans are used as a horse food.
(Botanical Experiment Station, Pretoria.)

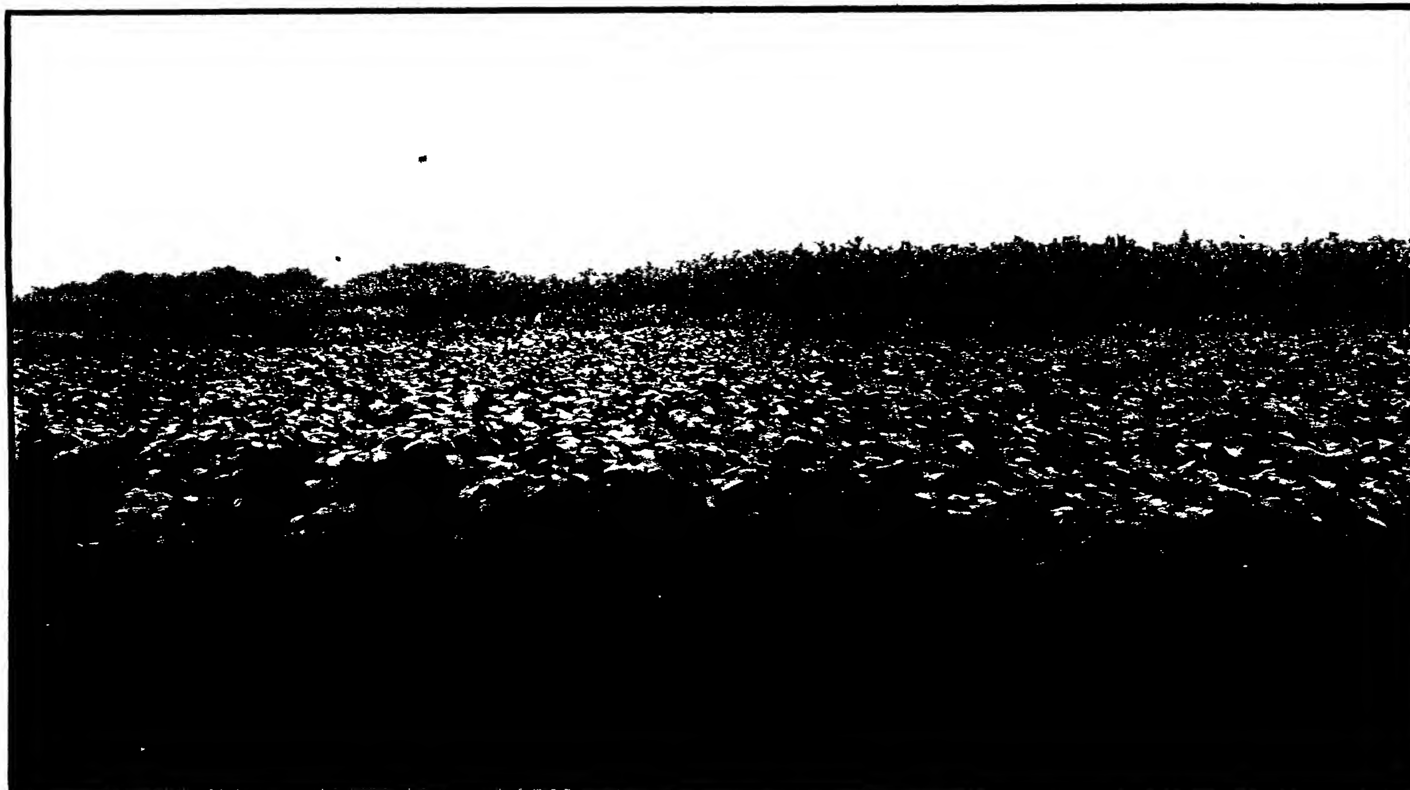

Plate CLXXXVII

Soy Bean.
(*Glycine hispida*.)

A grand leguminous crop for either ensilage or green manuring. In America the beans are used as a horse food.
(Botanical Experiment Station, Pretoria.)

Plate CLXXXVIII

Soy Bean.

(*Glycine hispida*.)

A grand leguminous crop for either ensilage or green manuring. In America the beans are used as a horse food.

(Botanical Experiment Station, Pretoria.)

Plate CLXXXVIII

The Khaki Weed.

(*Alternanthera echinata.*)

A weed likely to become dangerous in the Transvaal

Plate CLXXXIX.

The Globe Amaranth or Bachelor's Button.

(*Gomphrena globosa.*)

A weed rapidly spreading in the Transvaal.

per 112 lbs., f.o.b. London, for the best quality of Provence seed, thoroughly re-sifted for dodder, and at this figure Cape growers should be able to make a good profit after paying for the extra labour involved in selecting and cleaning properly.

But unless they are prepared to co-operate and fulfil requirements Transvaal farmers will be obliged to continue purchasing in Europe and Australia.

Several seedsmen inform us that they are now stocking only the best Provence seed, so that there need be no difficulty in obtaining it.

The greatest danger from dodder is due to the fact that it is generally unnoticed until it has flowered and scattered a good crop of seed. Some of these seeds may lie dormant in the soil for several years, so that the old proverb "one year's sowing means seven years' hoeing" is particularly applicable to this case. It has been suggested by some farmers who know the danger of letting dodder spread, that it should be proclaimed a "noxious weed," as has been done in the Oudtshoorn district, and that the terms of the Burweed Law should be made applicable to it.

It is regrettable that some farmers look lightly upon dodder, saying that it is the easiest thing in the world to eradicate it by burning. It is quite true that it can be done, and on a small half-acre plot the dodder-infected lucerne plant can be easily hoed out and burned when it first appears at little cost of time and money ; but in large fields it is not easily seen before it has done some damage and scattered seed for a future crop, and then it is by no means such an easy task to get rid of it ; in fact farmers often abandon badly infested fields to their fate. It adds a good deal to the expense of maintaining a stand of lucerne, to be persistently hoeing out and burning the dodder patches, and it gradually reduces the value of the stand.

It is far easier and cheaper to keep dodder out of a lucerne field by the use of thoroughly clean seed—even if this seed is a little more expensive in the first case—than to eradicate the pest when once established.

As the appearance of dodder is not familiar to every farmer, an illustration can be seen in Plate CLXXXII.

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No. 2.]

THE GLOBE AMARANTH OR BACHELOR'S BUTTON.

(*Gomphrena globosa*, Linn.)

By I. B. Pole Evans, B.A., B.Sc., Acting Botanist.

The Globe Amaranth (*Gomphrena globosa*) has been classified as one of the most common alien plants* of the Transvaal.

It well deserves this judgment, for to-day we see it everywhere in this Colony. Around Pretoria, on waste ground and elsewhere, the

*J. Burtt-Davy, F.L.S.: Alien Plants spontaneous in the Transvaal.—S.A.A.A.S., 1904.

plant has been specially conspicuous this season, and in many spots has choked out everything else and spread to such an extent that people have mistaken it for a relative, the "khaki weed," and have even advocated legislation with regard to it.

A short note by the Government Botanist relating to the "khaki weed" (*Alternanthera echinata*) appeared in the January number of this "Journal," but, owing to a mistake, a drawing of the weed was inadvertently omitted.

However, in this number we produce drawings of both the khaki weed and the Globe Amaranth (Plate CLXXXIX.), or Bachelor's Button as it is sometimes called.

The Globe Amaranth is readily distinguished from the khaki weed by its more erect habit, and its large pinkish-white flower-heads 1 to 1½ inches in diameter, terminating the branches; whereas, the khaki weed is prostrate in habit, and bears its small white flower heads, often clustered, in the axils of the leaves, never terminal.

Is this Globe Amaranth to be proclaimed a noxious weed under the Transvaal Laws, as some people urge? By some it is condemned, by others it is said to be a valuable food for horses.

We have made definite observations on this point with regard to horses and mules, and find that the plant is greatly relished by both. In fact, when mixed with hay the Amaranth was picked out and eaten first.

Several farmers from the High Veld have told me that the plant when cut young and made into hay makes excellent forage.

These points, together with the fact that the Amaranth is rarely seen to any size or proportions in well-grazed paddocks, are all in its favour, and do not appear to warrant its being proclaimed a noxious weed.

However, we intend to go into this matter much more fully, and in the meantime shall be glad to receive the opinions of farmers concerning the same.

The Globe Amaranth is well known as a common tropical weed. It probably originated from America, and is now widely dispersed throughout the tropical parts of Australia, India and Africa.

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No. 3.]

NOTES ON PLANT DISEASES.

By I. B. Pole Evans, B.A., B.Sc., Plant Pathologist.

I.

An Apple Disease.

(*Coniothecium chomatosporum*, Corda.)

A disease affecting apples as is shown on Plate CLXXXIII. has recently been the cause of much complaint and enquiry, and as it may appear irrespective of climatic conditions, wherever the apple is cultivated, a note as to the method of combating it is inserted here.

At present most of the apples affected in this manner have come from the southern border of the Transvaal, especially around Vereeniging and from the Orange River Colony.

The varieties attacked are chiefly Russet and Rome Beauty. No doubt others occur which are equally susceptible, but the ones mentioned above have specially come to our notice.

The disease is caused by the presence of a microscopic fungus which lives upon the surface of the fruit. This fungus is known to botanists under the name of *Coniothecium chomatosporum*, Corda. Very little is known regarding its parasitic nature or its geographical distribution. Apples at all stages of growth are disfigured. Those which are attacked at an early stage rarely reach the size of walnuts.

The disease first appears as minute cracks on the skin, and as the apple increases in size these cracks become deeper and deeper, until the core of the fruit is reached, when the apple soon withers and dies.

The cracking is brought about by the parasitic action of the fungus which indurates the outer skin of the fruit, and thus causes it to crack under pressure from within as growth takes place.

This trouble must not be confused with another apple disease well known in parts of Cape Colony as "Black Spot," "Scab" or "Cracking" due to the fungus *Fusicladium.*

It is true the cracking to a certain extent resembles that produced by *Fusicladium*, but in this case it is never accompanied by the dark olive green velvety patches or spots so characteristic of the "Scab" fungus.

Besides being found on the fruit, *Coniothecium* usually lives on the stem and branches, and is also present on fallen twigs and fruit.

The disease can readily be stamped out by spraying. The Bordeaux mixture* will be found the most efficient spray. The spraying should first be applied with the object of getting rid of any fungus that inhabits the stem and branches. To do this the tree should be thoroughly drenched with the fungicide as soon as the leaves have fallen; and leaves, twigs and fruits should not be allowed to rot under the trees, but should be removed, burnt or buried deep.

Spraying should again be commenced before the buds open, just before flowering, and soon after the blossoms fall, with one more spraying when the fruit is well set will probably be quite sufficient.

II.

Anthracnose of the Watermelon.

(*Colletotrichum lagenarium* (Pass.) Hals.)

Anthracnose of the watermelon has been described as "the worst fungous enemy of cucurbits in the States."

The same will be said of it in this country before long unless proper precautions are taken.

Watermelons, cucumbers, muskmelons and gourds all fall a prey to this fungus, which causes the disease known as "Anthracnose." But

* See "Transvaal Agricultural Journal," No. 17, Vol. V., p. 127.

this is not all; there is one other important plant which is readily attacked—viz., the bean.

Anthracnosed beans have been proved to communicate the "anthracnose" fungus to the cucurbits mentioned above, and in the same way diseased cucurbits have been shown to contaminate beans. Watermelons suffering from anthracnose have been noted this season in the Transvaal, while the fungus on the bean was identified on several occasions both this season and last.

Since the fungus on beans readily infects melons and *vice versa*, one will at once see that attention to the rotation of these crops is an important item.

The sowing of melons, etc., alongside diseased beans, or in soil that had carried such, would be fatal.

This parasite is particularly injurious to seedlings of cucurbits, attacking the cotyledons and young stems with deadly results, but perhaps to the ordinary observer it is on the fruit that it attracts most attention. Fruit, when once attacked, becomes bitter and quickly rots.

An affected watermelon is shown on Plate CLXXXIV.

The disease first appears on the fruit as minute dark green circular spots, which, as they enlarge in size, take on a light coloured centre surrounded by a dark green margin. In fact they look like a number of pinkish ulcers. These soon run together, and form a sort of patchwork composed of light coloured areas, from which masses of pink spores exude. The spores are conveyed from plant to plant by means of insects and other agencies, and, whenever conditions are favourable, germinate and renew the disease.

The affected tissue very soon cracks in various directions, and thus allows easy access of insect and further fungoid pests, which rapidly convert the fruit into a rotting mass.

This disease can readily be prevented. The secret of its prevention as with most other plant diseases is in anticipating it. That is to say, the plants should be regularly sprayed from their early youth onwards, whether there is any sign of fungus or not. The best and most efficient spray is the Bordeaux mixture referred to under the apple disease.

As soon as the plants are three to four inches high the spray should be applied, and should be continued at intervals of seven to eight days, and even more frequently during wet weather. The whole secret of success lies in maintaining a protective coating of the copper deposit on the parts liable to infection.

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No. 4.]

MILLETS FOR HAY.

By H. Godfrey Mundy, Assistant for Seed and Plant Experiments.

Some trials have been made this year at the Pretoria Agricultural Experiment Station in order to ascertain the comparative values of different varieties of millet when grown for hay.

The following points were kept in view as being desirable in a plant which is destined to produce hay, viz., fineness of straw, good height of straw, leafiness of stalk, and heavy heads with freedom from excess of "beard."

The plots were each 1-50th of an acre in area, and the seed was sown broadcast on November 7th, 1906. The soil was a medium strength red loam. The following varieties were experimented with: Red Siberian Millet, Kaffir Manna, Boer Manna, Golden Millet, Early Manna, Californian Green Moha, Japanese Millet, Moha de Hungerie and Panicum Germanicum.

The crop was grown on dry land, and assisted by the heavy rains exceptionally good results have been obtained. Bundles of these millets have been exhibited at some of the agricultural shows, and photographs illustrating four of the best plots will be found in this "Journal," at the end of the Botanical Section.

All the weights were taken while the crop was green, *i.e.*, immediately after cutting. When dried and weighed as hay they usually decreased 2-3rds in weight.

1. *Red Siberian Millet.*—Made a good start and was very thick upon the ground, but came into head early, and consequently did not grow to any height, about 2 feet being the limit. This is a fairly leafy variety, but it is inclined to get woody if left too long upon the ground. The heads were small, and much of the seed was scattered or stolen by birds. When harvested, on January 30th, 1907, the plot gave a green weight of 175 lbs., or a yield of 4¼ tons per acre.

If the season had been a dry one this crop would have been more unsatisfactory, as the straw would have been shorter and tougher.

2. *Kaffir Manna.*—This made a good stand, 2 feet 6 inches to 3 feet high, very leafy, with large heavy heads. The straw was thin and succulent. The crop was cut on January 30th, and weighed 360 lbs., or at the rate of 9 tons per acre. The hay was of nice quality and was readily eaten by stock, including horses.

3. *Boer Manna.*—Sown the same date, viz., November 7th; made a very good stand, and always looked well. Fully 3 feet high, very leafy and thin-strawed. A little later than the Kaffir Manna, but a heavier yielder. The crop was cut on February 6th, 1907, and weighed 568 lbs., or 14 1-5th ton per acre. The quality was good.

This plot is shown in Plate CXCIII. at the end of the section.

4. *Golden Millet.*—Came along nicely from the first; is a very rapid grower, and gives an enormous yield of good quality hay. The stems on the outside of the plot grew a little coarse, but in the centre they were only slightly thicker than those of Boer manna. The straw grew to an average height of 4 feet 3 inches, and in places even more. A good leafy variety, and free from any beard. The seed head closely resembles that of Pearl millet, but is smaller. This should be a very valuable variety for use in the Transvaal; if it lacks in quality in some people's opinion it should readily make up for this by its heavy yield.

It is a very heavy stooler, and requires to be sown thickly in order to prevent the straw becoming coarse.

The crop was cut on February 6th, and weighed 1,451 lbs. green, or at the rate of 36¼ tons per acre. A photograph of this plot is also shown. (Plate CXCI.)

The yield was probably abnormally large owing to the heavy rainfall. It seems probable that even if this variety does not find favour as a hay crop it should be most valuable for feeding green or for converting into ensilage, especially where owing either to late sowing or early frosts only a short growing period can be allowed.

5. *Early Manna.*—Sown November 7th, 1906, harvested January 30th, 1907. Came up well and made a good stand, though not over tall. The average height was from 2 feet to 2 feet 6 inches. The straw was nice and fine, carrying plenty of leaf, and being very free from woodiness. The heads were of good size and fairly free of beard. The hay made from this variety should prove of high quality.

The plot yielded 402 lbs. when green, or at the rate of 10 tons per acre.

6. *Californian Green Moha.*—This has straw of a beautiful fine texture ; the stems are very succulent, and there is an abundance of fine, leafy foliage. The general height is from 3 feet to 4 feet, and when in full head up to 4 feet 6 inches.

A photograph of this plot, Plate No. CXCII., is shown.

The crop was ready to cut on February 6th, 1907, and weighed 675 lbs., or at the rate of 16½ tons per acre, thus giving about one ton of *hay* per acre more than Boer manna, and the hay being very superior in quality.

7. *Japanese Millet* (Ko-kibi).—Grew splendidly, and was the only variety which did not suffer from sunburn when a fortnight's drought came at the end of November.

The plants were tall and strong and of an average height of 3 feet 6 inches. The stems are slightly hairy but fine and succulent, and the plant makes an abundance of leaf growth. There does not seem much to choose between this variety and Boer manna except that the Japanese is slightly earlier and seems to stand drought a trifle better. The quality of the hay would be much alike.

The yield given when the plot was reaped on February 6th was 551 lbs., which works out at 13¾ tons of green forage, or about 4½ tons of hay per acre. Plate No. CXC.

8. *Moha de Hongerie.*—Made a poor stand in spite of the good rains which fell ; appears to be a weak and feeble grower, and has little or nothing to recommend it when varieties such as some of the previous ones can be grown.

The straw was short, hard and wiry ; heads small and bearded.

The stand was quite thick upon the ground, but the plants only reached a height of about 2 feet, and then ceased to grow. The plot when cut weighed 304 lbs., or 7½ tons of green forage per acre.

9. *Panicum germanicum.*—Was also very poor, only reached a height of about 1 foot 9 inches, and then came into head and began to

turn woody. The stems were hard and not succulent ; very little leafage was made, and the heads were small and bearded ; the seed was taken by small birds as soon as it "set." Gives a light poor yield, and has little to recommend it. Was cut on January 30th and weighed 200 lbs. or 5 tons of green stuff to the acre.

The results of these trials should be helpful to farmers in determining what varieties of Millets to grow next year.

It would seem that Californian green moha has an advantage over Boer manna as regards weight of yield, and that Japanese millet, while giving practically the same return as Boer manna, is slightly more drought-resistant and about one week earlier.

In order to grow one of these heavy yielding varieties successfully thick sowing is essential, otherwise the stalks will become too robust and hard.

To produce a good quality straw for hay production about 10 lbs. to 15 lbs. of seed per acre seems to be the most satisfactory sowing, though much, of course, will depend on the climatic conditions of the season.

Finally, I would call attention to Golden Millet, which has given such a tremendous crop. This variety appears worthy of more attention, and if it cannot be grown sufficiently fine to make a really first-class hay for market, still it should be of great value to stock-owners in all parts for home feeding, and especially on the High Veld, where it may well be grown almost as a catch crop, when the main sowings of the season are completed, and give a heavy return before the early frosts set in.

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No. 5.]

FURTHER NOTES ON CHICORY CULTIVATION.

By H. Godfrey Mundy, Assistant for Seed and Plant Experiments.

As considerable attention has of late been given to the possibilities of growing this crop in the Transvaal, further notes on the results of some experiments carried out at the Government Experiment Station, Pretoria, during 1905-7, may not be without interest.

During the last twelve months up to December, 1906, the total value of chicory imported into the Transvaal was £3,396 ; of this only £466 worth represented the value of South African grown chicory. It may be possible, therefore to prevent that £3,000 odd from leaving the country and instead to divert it into the pockets of the Transvaal farmer.

The average crop of chicory per acre in America is stated to be 6 to 8 tons.

Chicory-growing was, however, dealt with at some length in an article by the Government Botanist and Agrostologist in the October, 1906, No. of this "Journal," and these notes are inserted here as an extension of the above article.

The main point to determine has been at what period of the year the crop could be sown with the best results.

During the months of November and December, 1905, several plots of chicory were sown down on dry land at the Experiment Station, Pretoria ; owing, however, to a very droughty season the plants made but little growth and the roots were not ready to raise until November 14th, 1906, thus taking nearly 12 months to mature when the normal growing period required by chicory is from 5 to 6 months. The land on which these plots were situated was unmanured, and had only been trenched to a depth of about 10 inches.

The following is a concise account of the experiment with results worked out per acre ; the weights were taken immediately after lifting, the tops having been removed. The plots were 1-200th acre in area :—

No. I. *Magdeburg Chicory.*—Sown November 29th, 1905 ; harvested November 14th, 1906 ; yielded 4¼ tons of roots per acre. The roots were fairly even in size and of good formation, but small. The number of roots per acre was 67,800.

No. II. *Coffee Brunswick* gave 42,400 roots to the acre, weighing a trifle over 4¼ tons ; these roots were well shaped and of good even size, tapering to a point and averaging about ¼ lb. when weighed green.

No. III. *Unnamed.*—Yielded 1¾ tons per acre ; the roots were small for the most part, and very fibrous.

No. IV. *Large-rooted Chicory.*—Sown December 1st, 1905, yielded 151,200 roots per acre, weighing 5 tons ; these, however, were rather small and uneven in shape, many of them being a mass of fine lateral rootlets.

No. V. *Red-leaved Lombardy.*—Sown February 23rd, 1906 ; gave 43,400 roots, weighing 2 tons ; these roots were small, forked and a mass of root hairs.

No. VI. *Large-rooted.*—Sown February 23rd, 1906 ; gave 35,600 roots per acre, weighing 1¼ tons about ; they were, however, of very poor quality and size, but fair shape, the average length being about 10 inches.

From these results it will be seen that none of the trials could be looked upon as satisfactory, the highest yield given being 5 tons per acre, and therefore considerably less than what an average crop should be, besides lacking in quality.

The necessity for deep cultivation was very clearly demonstrated by these experiments ; in nearly all cases it was evident that the root development had been checked by the firm soil, this in some cases causing forked roots, and in others a mass of small fibrous growth instead of one long clean tap-root such as the ideal chicory plant should produce.

Another point brought out was the hardiness of the plants to withstand frost—in a few cases the leaves turned a brownish red, but no other ill effects were to be seen.

It seemed clear on examining the results more closely that we had not struck the right time of year for sowing either in the end of

December or in the latter part of February, and we therefore determined in the autumn of 1906 to make a further trial, this time on a well-prepared seed-bed, and, if necessary, under irrigation

A dark red loamy soil was chosen as being suitable, and this was well trenched to a depth of two feet, and then manured at the rate of 9 tons of dung per acre and about 2 cwt. per acre of bone dust (burnt) ; previous to this the land had been heavily cropped, and was therefore in a somewhat impoverished condition.

A fine seed-bed was obtained, and after a light irrigation the seed was drilled in rows 10 inches apart on September 10th, 1906.

From the outset the crop came on well ; when about 3 inches high it was singled out and weeded, plants being left about 5 to 7 inches apart ; an endeavour was made to fill up gaps by transplanting those singled out, but for the most part this failed. After singling the crop was again irrigated, and from this time onward received only the natural rainfall.

Owing to the heavy rains which we have had this season, growth was rapid, and about the last week in December some began to show signs of running to seed ; in these cases the tops were cut off.

On January 1st, some of the plants began to have an unhealthy appearance, and on examination it was found that owing to excess of water the roots of many were rotting.

On January 3rd, 1907, the crop was lifted, after having been in the ground just under four months.

Four plots were this time under observation, and the following are the results obtained, weights per acre are again given before drying :—

No. I. *Magdeburg.*—82 lbs., or at the rate of 7 tons per acre.
No. II. *Brunswick.*—62 lbs., or 5 1-3rd tons per acre.
No. III. *Mixed.*—90 lbs., or 7¾ tons per acre.
No. IV. *Brunswick.*—94 lbs., or just over 8 tons per acre.

In all of these the roots were of excellent shape and quality—the different varieties varying slightly, but all of them showing the same uniformity of character. The roots were clean, smooth, free from side roots, and broke with a clean fracture and were very milky ; the average length of a root being 12—16 inches.

Plots I. and II. were those that suffered most from the rot, but a considerable number of roots were also affected on Plots III. and IV., and were unfit to raise for this reason. There is no doubt that if all the plots had been free from decay, Nos. I., III. and IV. would have scaled over the 100 lbs., or at the rate of just on 9 tons per acre.

The result cannot be looked upon as other than satisfactory, and it appears highly probable that if the crop had been sown a month or two later with the first rains, the results would have been equally good if not better, as the roots would not be so liable to rot if not approaching maturity at a time when the heaviest rains fell. I am of the opinion that another fortnight or three weeks in the ground would have materially increased the yield, and that there is no reason why the crop should not be sown in the end of October and harvested at the

beginning of March; the final stages of its growth would then be made under comparatively dry conditions, and the danger of rotting would be eliminated.

In conclusion it may be said that the prospects of growing chicory on a large scale seem particularly hopeful, as the crop does not require much labour except in the lifting.

Several farmers are making co-operative experiments with chicory this season, and if their reports are equally favourable it would seem that this crop is worthy of the Transvaal farmer's closer attention next year.

Further trials will be made this winter of growing chicory as a winter crop under irrigation.

* * * *

No. 6.]

REPORT ON NATIVE FIBRES FROM THE TRANSVAAL.

By Professor WYNDHAM R. DUNSTAN, M.A., F.R.S.,
Director, Imperial Institute.

These samples of fibrous materials were forwarded to the Imperial Institute by the Director of Agriculture, Transvaal, with a letter, No. 22,152, dated the 5th October, 1905, stating that the products had been collected by Mr. Maximo Abramsohn, and asking for a report on their technical and commercial value. The letter was accompanied by a list of the samples with some notes on their botanical origin.

The various specimens have been examined in the Scientific and Technical Department of the Imperial Institute, and a description of each product is given below, with the results of its investigation. Mr. Abramsohn has visited the Imperial Institute, and has furnished further information.

"GIFT-BOL" (*Buphane disticha*).

The samples of this product consisted of 80 pounds of large bulbs and a very small specimen of prepared fibre.

The bulbs were mostly about 2 or 3 pounds in weight, but varied from half-a-pound to 4 pounds. The outer part of the bulb consisted of light brown, dry, papery leaves or scales, whilst the inner portions were white and succulent, and contained a fairly large proportion of starch and a very small quantity of a bitter alkaloidal principle. Both outer and inner portions contained fine, soft fibre running longitudinally through the leaves. In most cases the bulbs were crowned with a tuft of young, succulent foliage leaves of a pale yellowish-green colour, whilst they terminated below in a hard, fibrous root-stock bearing tough broken roots and sometimes young succulent roots.

The "gift-bol" fibre has an entirely different origin from that of the ordinary fibres of commerce, and consequently possesses unusual characters. The fibre is derived from the fibro-vascular bundles of the leaves or scales of the bulb and is composed almost entirely of spirally-

thickened wood-vessels. The original wall of the vessel apparently remains as a thin sheet of cellulose. The spiral thickening does not become lignified except in some of the larger vessels. As the vessel dries, the thin wall ruptures and perishes, and the spiral thickenings having thus lost their connecting layer separate from one another and pull out as individual filaments. The fibres when withdrawn from the leaf appear therefore under the microscope as coils of spirally-wound filaments.

A specimen of fibre was prepared from the bulbs by the following method which was recommended by Mr. Maximo Abramsohn.

Several of the inner succulent leaves of the bulb were removed and cut longitudinally into pieces. These pieces were placed in a calico bag and well pounded with a hammer. The pulpy mass thus obtained was washed and well kneaded under water until the starch and pulpy matter had been removed from the fibre. The fibre was then boiled with water for a few minutes, and was afterwards allowed to dry in the air. In this way it was found that 200 grams of the inner leaves of the bulb yielded 3.8 grams of air-dried fibre, or 1.9 per cent. This result is probably somewhat low, since in working under laboratory conditions, and on so small a quantity of the material, it is difficult to avoid a loss of some of the fibre. By working on a larger scale it is probable that a yield of 2 to 2.5 per cent. would be obtainable.

The fibre obtained in this way was very fine, silky and rather weak, and closely resembled the specimen prepared in the Transvaal which is described below. On chemical examination, the fibre was found to contain 9.4 per cent. of moisture and 70.8 per cent. of cellulose (calculated on the dried material). After the fibre had been treated with chlorine, it gave a purple tint with sodium sulphite solution, the presence of some lignocellulose being thus indicated.

The small specimen of fibre which had been prepared in the Transvaal was contained in an envelope marked "gift-bol" and consisted of about one-eighth of an ounce of white fibre. This material was clean, fairly lustrous, and soft and limp to the touch. Owing to the extreme fineness of the product and to the difficulty of isolating the individual filaments from the groups or coils in which they were arranged, it was impossible to determine their strength by means of the testing machine. When tested by hand, however, the fibre appeared to be weak and was easily broken. The length of the fibres in the prepared material had a maximum of 1.5 inches, but generally varied between 0.4 and 1.0 inch. It is not improbable, however, that the fibre may be considerably longer as it exists in the leaf of the bulb, and becomes broken in the process of preparation. The individual filaments were found to have a diameter of about 1/10,000 inch, and are therefore about eight times as fine as ordinary cotton or four times as fine as silk. As already explained these filaments are usually grouped together in coils or twisted bundles, and these have a diameter from 1/4,000 to 1/2,000 inch.

Specimens of the clean fibre were submitted to technical and

commercial experts for their opinion as to the possibility of its utilisation for textile purposes.

On the recommendation of one of the leading authorities on textile industries, a sample of the material was referred to a firm of silk spinners. This firm reported that after careful examination of the fibre, they were convinced that it could not be manipulated by spun-silk machinery.

Another well-known authority on the utilisation and spinning of fibres reported that the material was far from satisfactory with respect to its "handle" owing to lack of elasticity. The opinion was expressed that, on account of its fineness and its deficiency in strength the fibre would become broken up in the processes preparatory to spinning and the strength of the manufactured yarn of fabric would thereby be impaired. For these reasons, namely, the weakness of the fibre and the shortness which would result during preparation, it was considered that fine yarns could not be satisfactorily produced. The utilisation of the material for the manufacture of coarse yarns would not be practicable unless the fibre could be produced so cheaply that the yarn could compete with the lower types of cotton yarns, and even in this case it was thought that the fibre would not meet with any considerable demand since it would probably prove inferior to cotton in durability.

The opinions of these experts are entirely in accord with the conclusions arrived at in the Scientific and Technical Department of the Imperial Institute, which may be summarised as follows :—

It is improbable that the "gift-bol" fibre could be used for similar purposes to those to which cotton and silk are applied, for, owing to the extreme fineness of the fibre, cotton preparing and spinning machinery would be entirely unsuitable for dealing with it, whilst the shortness of the fibre would preclude its being worked by "waste-silk" or "spun-silk" machinery. It is possible that, without isolating the individual filaments of the material, the groups of fibres might be spun, but the resulting yarn would be very coarse and could only be used as a substitute for "cotton waste" yarn or similar materials.

It appears, therefore, that this fibre will be of little value as a textile raw material.

Sansevieria Fibre.

The samples consisted of leaves or strips of leaves, contained in eight bottles, and a small specimen of the extracted fibre.

Some of the whole leaves were submitted to the Royal Gardens, Kew, where they were identified as those of *Sansevieria æthiopica*, Thunb.

The leaves were dark green, fleshy and fibrous, and from 7 to 18 inches long. A specimen of the fibre was extracted from the leaves by boiling them with water and afterwards scraping and washing the

Plate CXC.

Japanese Millet.
A fine crop for hay.

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Plate CXC

Japanese Millet.
A fine crop for hay
(Botanical Experiment Station Pretoria.)

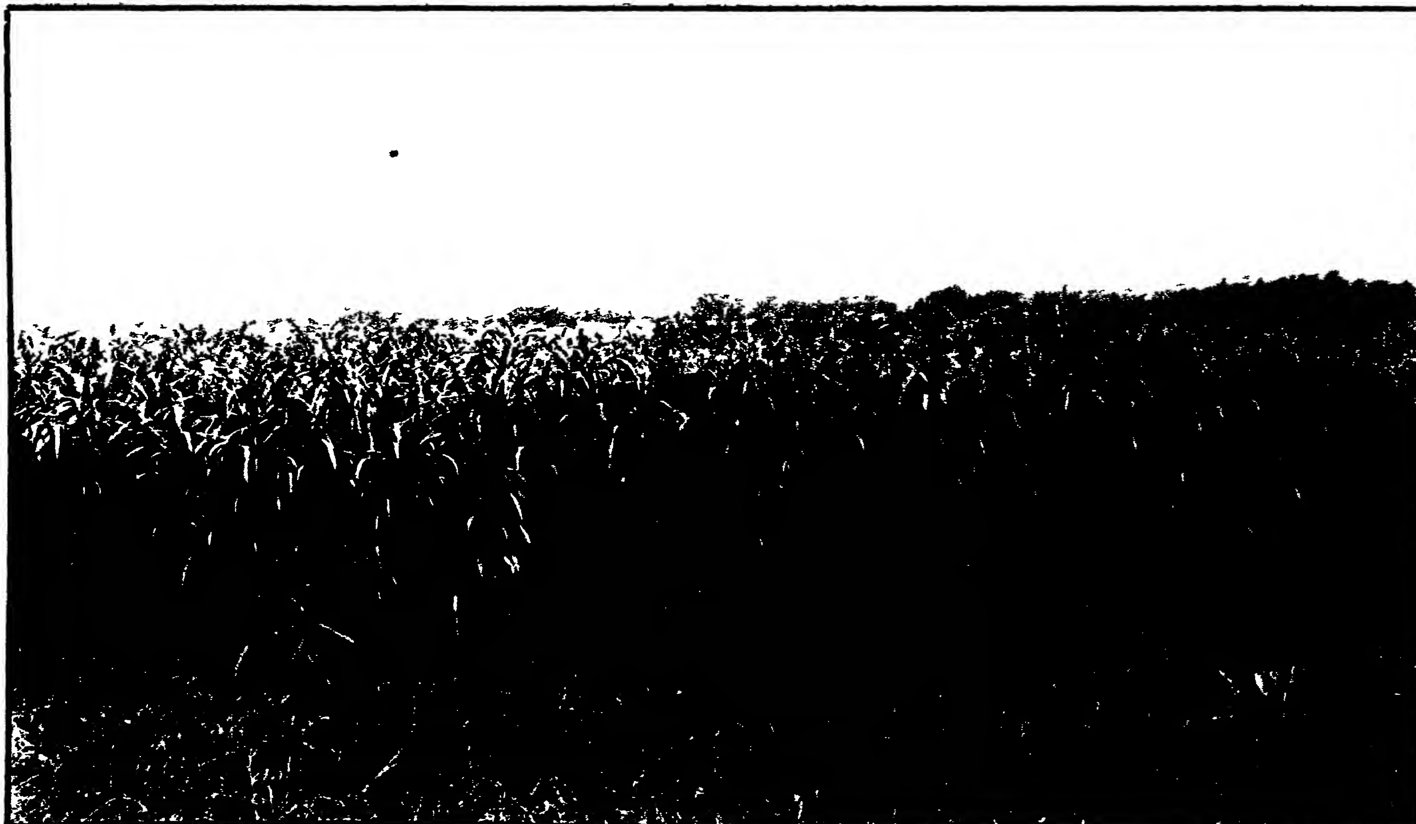


Plate CXCI.

Golden Millet.

Gave a green yield of 36 tons to the acre (Botanical Experiment Station, Pretoria.)

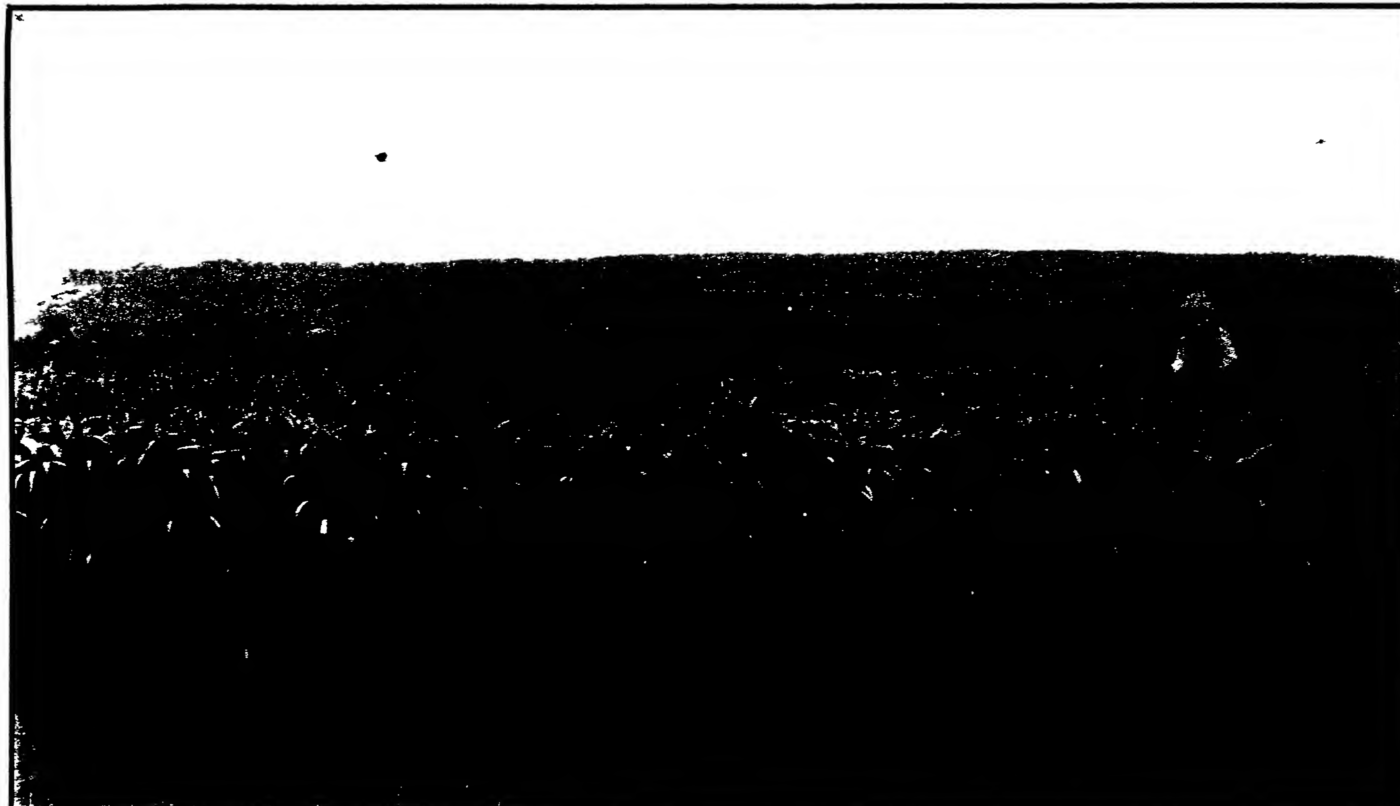


Plate CXCII

Californian Green Moha.
A very large variety of Millet
(Botanical Experiment Station, Pretoria)

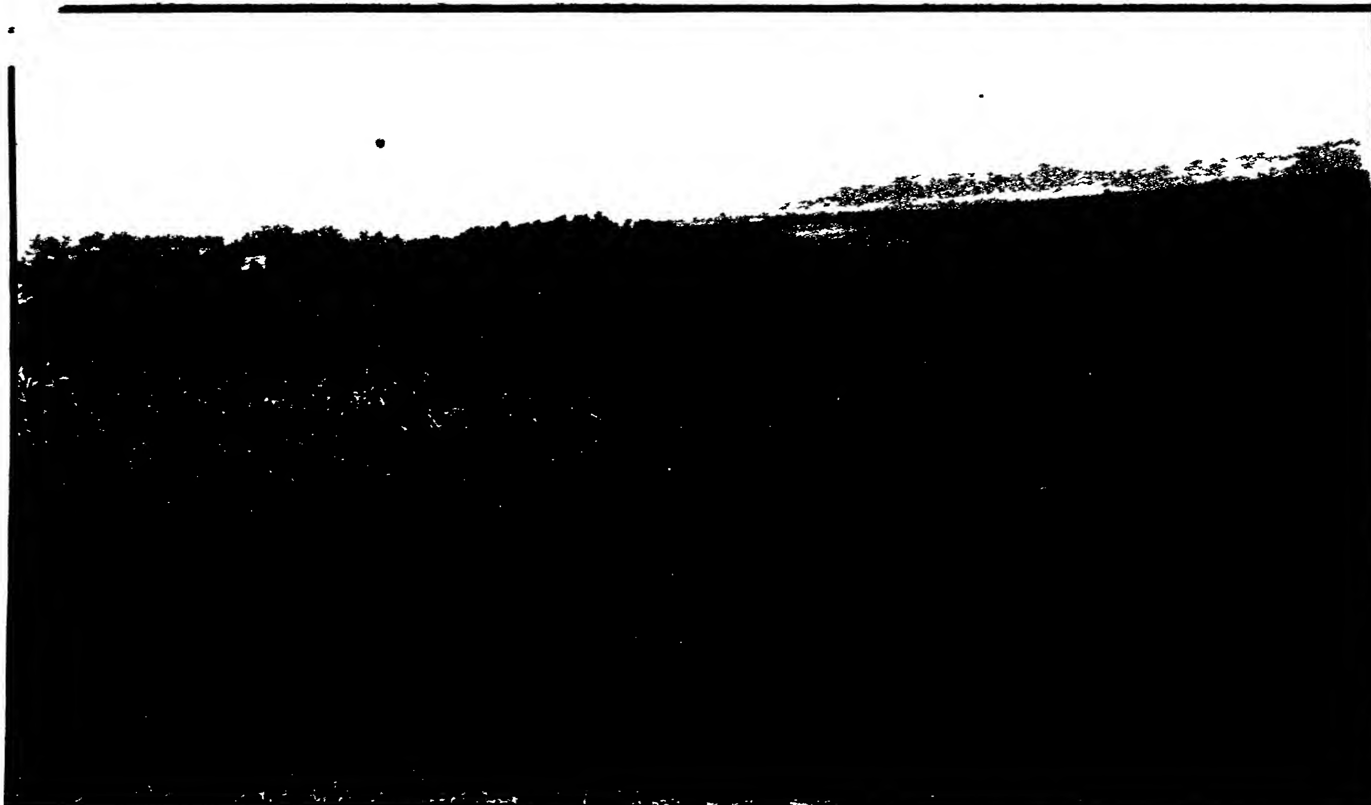


Plate CXCIII.

Boer Manna.

(Botanical Experiment Station Pretoria.)

product. The fibre thus obtained was fairly strong and fine, and resembled samples of Sansevieria fibres previously examined in the Scientific and Technical Department of the Imperial Institute.

The small specimen of extracted fibre accompanying the leaves was much tangled, but was clean, nearly white, fairly strong and somewhat finer than most samples of Sansevieria fibres.

There is no doubt that this fibre is of good quality and would be of value for the manufacture of cordage. It is desirable, however, that the fibre should be extracted from the larger leaves in order that it may be obtained of greater length. The commercial value of Sansevieria fibre depends to a considerable extent on the length of the material.

In order that the economic value of this product may be more definitely determined, a sample of this fibre (about 7 pounds) of full length should be carefully prepared and forwarded to the Imperial Institute so that it may be thoroughly examined and its commercial value ascertained by reference to experts.

Fibre of Asclepias Fruticosa (*Gomphocarpus fruticosus*).

The samples consisted of strips of bark, contained in five bottles labelled "Melk Bosch, *Asclepias fruticosa,*" and a small specimen of the extracted fibre.

The strips of bark were of a pale yellowish-green colour, and from 18 to 22 inches long. A sample of fibre was extracted from the bark by boiling it with water or very dilute alkali and scraping and washing the product. The material thus obtained consisted of bundles or groups of fibres which had been partially separated into their ultimate fibres, and was clean, lustrous, fairly soft to the touch and of a pale greyish colour. The product was of poor strength and the ultimate fibres were 0.7 to 1.2 inches long, with an average length of 0.9 inch.

On microscopical examination the fibres were found to be smooth, of even diameter, and to bear transverse markings, and in these respects resemble flax fibre. The diameter varied from 1/2,250 to 1/1,000 inch with an average of 1/1,600 inch.

A portion of this fibre prepared in the Scientific and Technical Department was submitted to chemical examination with the following results :—

Moisture, per cent. ..	6.6	
Nitration, gain per cent	46.2	(calculated on the dried fibre).
Cellulose, per cent. ..	84.2	(calculated on the dried fibre).

The fibre, after treatment with chlorine, gave little or no coloration with solution of sodium sulphite, and the nitrated product was nearly white. These facts indicate that the fibre is not lignified

but belongs to the pectocellulose class of fibres, of which flax is the most important member. On comparing these results with those yielded by a sample of the fibre of *Asclepias semilunata* from Uganda, which has been examined in the Scientific and Technical Department (*vide* "Bulletin of the Imperial Institute," Vol. III. 1905, pp. 316-318), it is evident that the fibres are very similar in composition.

	Asclepias fruticosa.	Asclepias semilunata.
Moisture, per cent.	6.6	7.7
Nitration, gain per cent.	46.2	46.5
Cellulose, per cent.	84.2	80.4

Both fibres contain a very large proportion of cellulose and undergo a considerable increase of weight on nitration.

The small specimens of extracted fibre, which accompanied the strips of bark, were white, lustrous, and flax-like. The material resembled the fibre of *Asclepias semilunata* of Uganda, which has been already alluded to. The fibre was less broken up than the sample prepared in the Scientific and Technical Department, and was very clean, of fair but uneven strength and harsh to the touch. The ultimate fibres were very fine and lustrous.

The fibre of *Asclepias fruticosa* possesses valuable properties, and if the material could be easily extracted from the bark without sacrificing its length, it could no doubt be spun into a yarn resembling that of flax or ramie. The richness of the fibre in cellulose and the large increase of weight occasioned by nitration show that the material might possibly be useful for the manufacture of explosives. A series of trials is at present being made with fibres of this type in order to ascertain their suitability for this purpose, and it is not improbable that the present fibre, if obtainable in large quantities, would be particularly serviceable.

Hypoxis Species.

The samples consisted of a small bulb and small specimens of gum and fibre.

The bulb was of dark brown colour, and bore a tuft of dead leaves, and some short, harsh, bristly fibre in a circle at the base of the leaves. Immediately below the fibre the remains of the roots were attached to the sides of the bulb, the lower part of which was free from roots and terminated in a point. There were numerous small "tears" of gum on the surface, and, on cutting the bulb, a gummy liquid exuded.

The small specimen of gum, consisting of one "tear," resembled the gum adhering to the bulb, and was of a pale, greenish-yellow colour. On placing the gum in water it swelled up but did not dissolve, its behaviour in this respect resembling that of gum tragacanth. It seems improbable that the gum would be of any commercial value, or that the small quantity yielded by the bulb would repay the cost of collection.

The specimen of fibre consisted of dark brown, smooth, stiff and wiry, somewhat lustrous, curly fibres, which varied in length up to four or five inches. The product was resilient, fairly strong, but slightly brittle. The fibres were elliptical in section, the longer diameter measuring 1/40 to 1/50 inch whilst the shorter measured 1/120 to 1/150 inch.

The fibre resembled horsehair, but was too short to be utilised as a substitute for this material in the manufacture of hair fabrics. The product could be used, however, either alone or mixed with hair as a stuffing material in upholstery, although it does not appear likely that its collection and employment for this purpose would prove remunerative.

HELICHRYSUM SPECIES.

This small specimen, labelled "Helichrysum," consisted of some nearly white, downy, fibrous leaves and a few bright yellow, "everlasting" flowers.

In order to determine the possibility of using the leaves for the manufacture of paper, the percentage of cellulose in them was estimated. The following results were obtained :—

Moisture, per cent. ..	9.4
Cellulose, per cent. ..	47.1 (calculated on the dried leaves)

The ultimate fibres had a length of 3.4 to 4.2 mm. (0.14 to 0.17 inch), with the average of 3.5 mm. (0.14 inch).

In the following table these results are compared with those furnished by a sample of Spanish esparto grass which has been examined in the Scientific and Technical Department :—

	Helichrysum.	Spanish esparto grass.
Moisture, per cent.	9.4	13.2
Cellulose	47.1	54.8

Length of ultimate fibre—Helichrysum : 3.4 to 4.2 mm. (0.14 to 0.17 inch) ; Spanish esparto grass : 0.9 to 2.5 mm. (0.04 to 0.10 inch).

These results show that the leaves of *Helichrysum* would no doubt serve as a paper material as they contain a large proportion of cellulose and an ultimate fibre of good length. The possibility of utilising the product in this way, however, would of course depend upon the cost of the material as compared with that of esparto grass or wood pulp, and upon the quality of the paper which it would yield.

The quality of the paper furnished by these leaves could only be ascertained by technical trials with large quantities of the material.

(Signed) WYNDHAM R. DUNSTAN.

22nd March, 1906.

No. 7.]

[COPY.]

IMPERIAL INSTITUTE.

(South Kensington, London, S.W.)

REPORT ON TWO SAMPLES OF *SANSEVIERIA EHRENBERGII* FIBRE FROM BRITISH EAST AFRICA.

BY Professor WYNDHAM R. DUNSTAN, M.A., F.R.S., Director.

These samples of fibre were forwarded to the Imperial Institute by the Acting Director of Agriculture, Transvaal, with a letter, No. 29,925, dated the 21st December, 1905, stating that the products had been grown near Mombasa on a tract of land in which a Johannesburg firm is financially interested, and asking for a preliminary report on their commercial value.

The samples have been examined in the Scientific and Technical Department of the Imperial Institute, and have been compared with a series of Sansevieria fibres from British East Africa which formed the subject of a report (No. 9832), dated the 6th November, 1905, a copy of which is sent herewith. The results of the examination are given below.

Sample No. 1.—This sample, labelled "*Sansevieria Ehrenbergii* fibre, collected by H. A. Baily, M. No. 67," consisted of 1½ ounces of light brown, non-lustrous fibre which varied in length from 2 feet to 3 feet 3 inches, but was mostly about 3 feet long. The material was of very mixed character, the greater part being coarse, harsh, fairly strong but very brittle, whilst the remainder was much finer and weaker. The sample had been very imperfectly cleaned, and contained much pulpy matter still adhering to the fibre.

Sample No. 2.—This sample, labelled "*Sansevieria Ehrenbergii* fibre, from H. A. Baily, M. No. 68," consisted of 1¼ ounces of fibre of irregular length ranging from 3 feet to 5 feet 6 inches, but mostly about 5 feet long. The product had been very badly prepared and still contained much of the leaf pulp. The material was of good colour, being much paler than sample No. 1, but was more tangled and of poorer strength.

These fibres resemble the sample of *Sansevieria Ehrenbergii* (No. 3) described in the Report (No. 9,832) to which reference has already been made. Of the present samples, however, No. 1 is somewhat better cleaned and of better colour than the above-mentioned specimen, but is rather coarser and more brittle. Sample No. 2 is also of better colour, but is inferior in strength.

Neither of the samples is in a suitable condition for the market, but there is no doubt that, if carefully prepared, the fibre would be of good commercial value and readily saleable in this country.

(Signed) WYNDHAM R. DUNSTAN.

16th February, 1906.

[COPY.]

IMPERIAL INSTITUTE.

(South Kensington, London, S.W.)

REPORT ON *SANSEVIERIA* FIBRES FROM BRITISH EAST AFRICA.

BY Professor WYNDHAM R. DUNSTAN, M.A., F.R.S., Director.

These samples of fibre were forwarded to the Imperial Institute by the Director of Agriculture, Nairobi, British East Africa, with a letter dated the 3rd March, 1905, asking for a report on their quality and commercial value. The fibres were accompanied by five botanical specimens which were sent for identification.

The fibres have been examined in the Scientific and Technical Department of the Imperial Institute, and have been submitted to experts for commercial valuation. The botanical specimens have been referred to the Director of the Royal Gardens, Kew, for identification.

A description of the samples and an account of the results of the enquiry is given below.

Sansevieria Fibre No. 1.

This sample was labelled "F. No. 1, S. Volkensii?" and consisted of about ½ lb. of slightly lustrous, brownish coloured fibre which had been badly cleaned and was harsh to the touch, fairly strong, and varied in length from 2 feet 3 inches to 3 feet 3 inches.

The botanical specimen labelled "S. Volkensii? Plant" was identified at the Royal Gardens, Kew, as Sansevieria Ehrenbergii, Schweinf.

On chemical analysis the fibre gave the following results :—

Moisture, per cent.	9.5
Ash, per cent.	1.7
a. Hydrolysis loss, per cent.	13.4
b. Hydrolysis loss, per cent.	17.3
Acid purification	5.7
Cellulose, per cent.	64.4

Length of ultimate fibre : 1.3 to 2.8 mm. or 0.05 to 0.11 inch.

On comparing these results with those yielded by other specimens of Sansevieria fibres which have been examined in the Scientific and Technical Department of the Imperial Institute (see table on page 7), it is evident that the present sample of fibre contains a low proportion of cellulose and is very susceptible to attack by boiling dilute alkali (*a* and *b* hydrolysis). There can be no doubt that this inferiority is due to the defective preparation of the sample.

The commercial experts reported that the fibre was harsh, dry, of yellowish colour, fair strength, had been roughly cleaned and was worth about £28 per ton in the London market.

Sansevieria Fibre No. 2.

This sample was labelled "F. No. 2, *S. Guineensis*," and consisted of about ½ lb. of fibre which was of a cream colour with brownish stains, had been very imperfectly cleaned, was harsh, slightly lustrous, of poor strength, and from 3 feet to 3 feet 9 inches long. This fibre was of much coarser character than the sample of *S. Guineensis* from Sierra Leone referred to in the table on page 7.

The results of the chemical examination are given below, and show, as in the previous case, that the fibre is of comparatively poor quality, which is chiefly, if not entirely, due to its having been incompletely cleaned :—

Moisture, per cent.	8.9
Ash, per cent.	1.2
a. Hydrolysis loss, per cent.	11.5
b. Hydrolysis loss, per cent.	15.3
Acid purification loss, per cent.	3.8
Cellulose, per cent.	62.0

The commercial experts reported that this fibre was softer than the preceding sample, was of fair length, mixed yellowish colour, partly tender, only half cleaned and contained some hard ends, and of nominal value £27 to £28 per ton.

Sansevieria Fibre No. 3.

This sample was labelled "F. No. 3, S. Ehrenbergii," and consisted of about 1½ lb. of pale brown fibre which had been very badly cleaned, the ends of the leaves having been left untouched. The material was harsh, fairly lustrous, somewhat weak and brittle, and varied in length from 4 feet 3 inches to 5 feet 9 inches.

On chemical examination this fibre gave the following results. The remarks made with reference to the results obtained with samples Nos. 1 and 2 are equally applicable to this sample :—

Moisture, per cent.	9.4
Ash, per cent.	1.0
a. Hydrolysis loss, per cent.	16.0
b. Hydrolysis loss, per cent.	21.8
Acid purification loss, per cent.	1.6
Cellulose, per cent.	59.2

The commercial experts reported that the fibre was rough and pithy, of good length, only half cleaned, and worth about £26 to £27 per ton.

Sansevieria Fibre No. 4.

This sample, labelled "S. No. 4," consisted of about 1 oz. of fibre which was of cream colour and had been fairly well cleaned, but contained a small amount of adherent green tissue. The material was fairly lustrous, less harsh than the three previous samples, of fair strength and about 2 feet long.

The botanical specimen labelled "S. No. 4 plant" could not be identified in the absence of flowers.

The results of the chemical examination of this fibre are given below :—

Moisture, per cent.	9.8
Ash, per cent.	1.0
a. Hydrolysis loss, per cent.	10.8
b. Hydrolysis loss, per cent.	14.1
Cellulose, per cent.	76.1

On comparing these figures with those obtained with other Sansevieria fibres (see table on page 7) it is seen that this fibre is of good quality and, in its chemical composition and behaviour, closely resembles the sample of *Sansevieria zeylanica* received from Assam.

The commercial experts reported that the fibre was short, soft, of mixed strength, and worth £24 to £25 per ton.

It is important that the botanical origin of this fibre should be ascertained, and it is therefore desirable that, if possible, further specimens, including flowers, should be forwarded to the Imperial Institute for the purpose.

Sansevieria Fibre No. 5.

This sample, labelled "S. No. 5," consisted of about 2 oz. of pale brown fibre of a stiff, brush-like character. The material was of good strength, but somewhat brittle, and was about 1 foot 6 inches long.

The botanical specimen of "S. No. 5" plant was identified at the Royal Gardens, Kew, as *S. Guineensis*, Willd.

On chemical examination the fibre gave the following results :—

Moisture, per cent.	9.1
Ash, per cent.	0.7
a. Hydrolysis loss, per cent.	8.3
b. Hydrolysis loss, per cent.	12.6
Acid purification loss, per cent.	1.2
Cellulose, per cent.	61.6

On comparing these figures with those yielded by a sample of *S. Guineensis* fibre from Sierra Leone (see table on page 7), it is evident that there is a great difference in the proportion of cellulose contained in these materials. A corresponding difference appears in the general character of the fibres, that from Sierra Leone being much finer and softer and possessing none of the stiff, brush-like nature which marks the present sample. This variation may be due to a difference in the age of the plants or of the leaves from which the fibres were extracted or to some local circumstance affecting the growth of the plant and the character of the fibre produced. This sample of *S. Guineensis* fibre appears to be better cleaned than was sample No. 2, but is much coarser.

The commercial experts reported that the sample consisted of

short, stiff fibre, fairly well cleaned, of good strength and worth from £20 to £22 per ton.

Botanical Specimens Nos. 6 and 7.

The botanical specimens labelled "S. No. 6 plant (no fibre)" and "S. No. 7 plant (no fibre)" were identified at the Royal Gardens, Kew, as belonging to the genus *Sansevieria*, but the species could not be determined.

In the following table the results obtained in the chemical investigation of these fibres are collected and compared with the corresponding figures furnished by other specimens of Sansevieria fibres which have been examined in the Scientific and Technical Department of the Imperial Institute.

	Sansevieria Fibre No. 1	*Sansevieria* Fibre No. 2	*Sansevieria* Fibre No. 3	*Sansevieria* Fibre No. 4	*Sansevieria* Fibre No. 5	*Sansevieria guineensis* from Sierra Leone	*Sansevieria zeylanica* from Angoorie, Assam	*Sansevieria trifasciata* from Nazira, Assam
Moisture, per cent	9·5	8·9	9·4	9·8	9·1	10·6	9·4	9·0
Ash, per cent	1·7	1·2	1·0	1·0	0·7	0·4	0·7	0·6
a Hydrolysis, loss per cent ..	13·4	11·5	16·0	10·8	8·3	8·9	11·8	10·0
b. Hydrolysis, loss per cent ...	17·3	15·3	21·8	14·1	12·6	13·9	14·9	12·6
Acid purification, loss per cent	5·7	3·8	1·6		1·2	1·8	1·4	2·3
Cellulose, per cent. ...	64·4	62·0	59·2	76·1	61·6	78·0	75·6	74·4

The results of the investigation of these Sansevieria fibres lead to the conclusion that these products are of good commercial value, and would probably repay cultivation. If, however, these materials are prepared for export, more care should be exercised in their extraction and cleaning. The commercial experts stated that none of the present samples were in good marketable condition and consequently the values given must be regarded as nominal, but added that if the products were properly cleaned they would probably realize several pounds per ton above the prices quoted.

(Signed) WYNDHAM R. DUNSTAN.

6th November, 1905.

[COPY.]

REPORT OF LIEUT.-COLONEL E. V. STACE TO SIR E. BARING.

"In November last (1891) a bale of the fibre was sent to the Government of Bombay. This was sent to England, and the reports have just been received. I must state here that the fibre was prepared in the roughest and rudest manner by ignorant Somalis in the manner described in the accompanying copy of a memorandum which I wrote on November 22nd last, yet the price obtained was, I think, a very fair one, and might be considerably increased if the fibre were properly prepared.

"The report of the Bombay Company (Limited) on the fibre sent by the Government of Bombay states that it was sold at the rate of £16 10s. per ton. 'Our London brokers valued the parcel at about the same price, and it is pretty evident that in larger quantities this article would meet with a ready sale.' And again, 'This fibre compares favourably with the many new types we see from various countries, which are frequently too poor in colour, or too short, brittle, and full of pith. Yours is of good strength, very nice colour and length.' The brokers further reported the fibre 'all very nice colour, and good strength and clean . . . . This seems a very saleable article if once introduced.'

"I need scarcely say that the small quantity sent was very much against a better price being obtained; the sale was by auction of what was really but a sample.

"There are vast quantities of the aloe growing in Somaliland. The people themselves will do nothing towards making a trade in the fibre; indeed, they have not the means to work it profitably, though they use it extensively themselves for ropes and other articles. I have a specimen growing here (Aden) over 7 feet in length, though I admit that this is exceptional; still I am informed that the wild plant might be materially improved. I have no knowledge whatever myself on the subject, but I have thought that if the existence of the plant and value of the fibre be made known in England through the Chambers of Commerce, it is possible that some persons with experience might be induced to make the necessary inquiries regarding a profitable production of the fibre."

(Signed) E. V. STACE.

(Dated) Aden, January 31st, 1892.

MEMORANDUM REGARDING THE ALOE FIBRE OF SOMALILAND.

"The following is gathered from various sources in England and Somaliland. I have never seen the fibre prepared myself.

"The plant is not cut; it is pulled out of the ground; the sharp points are cut off; the plant is then divided in two down the centre; the pieces are then beaten with a stick until they become soft. The fibre then is extracted by placing the divided plant between two pieces of wood which are fastened tightly together, and the plant is pulled

through them, leaving the fibre. This is then placed in the sun to dry for about half-an-hour. No water is used; the Somalis say that that blackens the fibre. The plant should be treated as soon as possible after being pulled up to prevent the drying of the sap.

"Regarding a fibre sent to England (similar to that sent to Bombay), it was considered that the fibre should be whiter, and that it was rather short; but that any quantity of the same as sent would be well received, and it was valued at £21 to £22 per ton. It wanted more bleaching in the sun and washing in water, and should be well cleaned.

"Death's patent fibre cleaning machine costs about £70; it requires either water-power or a 5-horse-power steam-engine of English make to drive it; this costs £150.

"If the aloe is left lying for a day or two in the sun it ruins it; it should be treated at once, and under sheds.

"I know of no water-power within any reasonable distance of the coast.

"There appears to be any amount of aloe within reasonable distance. I have heard that it would be much improved by being properly cultivated, such as thinned in places where it is growing too rapidly.

"Labour is obtainable at the seaport towns, but the Somali is extremely lazy, and it might be necessary to import Arab labourers at first, though regular employment for the Somalis, who swarm as idlers about the ports, would be very desirable."

REPORT FROM MESSRS. IDE AND CHRISTIE TO ROYAL GARDENS, KEW.

"We duly received your favour of the 18th instant, accompanying a sample of fibre from a plant known as the 'Aloe of Somaliland.'

"This is an excellent fibre of fair length, and with plenty of 'life.' In character it strongly resembles the best Sisal hemp, with which we should have classed it, but for your statement that it is derived from a *Sansevieria*

"With the exception of its colour, its preparation is perfect, and even as it is we value it to-day at £25 per ton. We are of opinion that if care were taken to improve the colour, a considerably higher price would be readily obtainable, perhaps as much as £50 per ton, if a pure white fibre could be attained without loss of strength and lustre."

* * * *

No. 8.]

IMPERIAL INSTITUTE.

(South Kensington, London, S.W.)

REPORT ON A SAMPLE OF SILK COTTON FROM MADAGASCAR.

BY Professor WYNDHAM R. DUNSTAN, M.A., F.R.S., Director.

This sample (B. 212/6/76) of silk-cotton was forwarded to the Imperial Institute by the Acting Director of Agriculture, Transvaal,

with a letter—No. 2,147—dated the 24th January, 1906, stating that the product was collected in Madagascar and asking for information with regard to its commercial value and the name of the plant from which it was derived.

The sample has been examined in the Scientific and Technical Department, and is described below.

The specimen consisted of one capsule, about 6 inches long and 1¾ inches in diameter, which contained a number of seeds embedded in a mass of floss or silk-cotton. From the appearance and form of the capsule and from a comparison of the seeds and fibre with those of known flosses or silk-cottons, there can be little doubt that the product is derived from *Eriodendron anfractuosum*, the tree which yields the well-known "kapok" of commerce which is largely exported from Java. The capsule yielded 22.4 per cent. of its weight of clean fibre which possessed the usual properties of "kapok."

The material was extremely soft and silky to the touch, of good, even, deep cream colour, of very good lustre and 0.6 to 1.1 inches long, a quantity of shorter fibres being present. The diameter of the fibre measured 1/2500 to 1/1000 inch, with an average of 1/1300 inch.

On microscopical examination the fibre was found to be fine, smooth and regular.

The product was in every way equal, if not superior, to the standard sample of Java "kapok" used for comparison. Although "kapok" is exceedingly lustrous and silky, it cannot be spun owing to its shortness, smoothness of surface and lack of strength. On account of its resiliency, however, the fibre is very suitable as a filling material for upholstery, and is somewhat extensively utilised for this purpose.

There is no doubt that "kapok" of the quality of the present sample would be of good commercial value, that exported from Java being worth 5d. to 6d. per lb. at the present time in the London market.

Further particulars regarding the "silk-cottons" and their technical applications will be found in the article upon "Indian Vegetable Flosses or Silk-cottons" in the "Bulletin of the Imperial Institute," Vol. iii. (1905), p. 221.

(Signed) WYNDHAM R. DUNSTAN.

15th March, 1906.

* * * *

No. 9.]

MEXICAN THISTLE: *Argemone mexicana ochroleuca*, Lindl.

This weed has been present for two or three years on the Pretoria Townlands, near the old Cemetery, and is now spreading along the Skinner's Spruit and Aapies River near Daspoort.

A correspondent has recently sent us specimens from Zeerust, where he says that it is "slowly but surely spreading over the Marico, and before long will make itself felt ; large patches can be seen on the Zeerust Commonage and in neglected gardens. There is no doubt that

it greatly impoverishes the soil, as grass and other weeds do not thrive amongst them. I am of opinion that the Mexican Thistle is injurious to stock and ought to be proclaimed a noxious weed, under the same law as *Xanthium spinosum* or Burr-weed."

In some districts of Cape Colony the Mexican Thistle has been proclaimed a noxious weed under the Divisional Councils Act.

While it may prove desirable to follow this example in the Transvaal, we should like to know more about the weed before doing so. It would be unwise to proclaim more weeds than can be dealt with, and it is detrimental to good government to have laws on the Statute Book which are a dead letter.

Any further information as to the injurious character of this weed will be welcome.—J. B. D.

* * * *

No. 10.]

WEIGHTS OF SEED PER BUSHEL.

In this country where a "bag" is the commonest measure used to denote a certain quantity (often indefinite) of seed, it is puzzling to a farmer to be told he should sow so many bushels of seed to the acre.

The following table of bushel weights of seed of the more common Transvaal crops has been compiled in the hope of doing something towards mitigating this difficulty :—

		lbs.
1 Bushel of	Maize	56
"	Wheat	60—65
"	Oats	42
"	Barley	55
"	Rye	54
"	Peas	63—65
"	Beans	63—66
"	Vetches or Tares	64
"	Sainfoin	28
"	Lucerne	60—62
"	Clover	64—66
"	Lupins	62
"	Mangel or Sugar beet	21—22
"	Chicory	27—30
"	Buckwheat	48
"	Rape	50
"	Sorghum	45 approx.
"	Millet, Golden or German	50
"	Boer Manna	50 approx.
"	Hungarian Millet	48
"	Castor Beans	46
"	Pea-nuts	22
"	Italian Rye Grass	18—21
"	Perennial Rye Grass	24—28
"	Timothy	48
"	Rescue Grass	14 approx.
"	Tall fescue	14 "
"	Reed fescue	14 "
"	Burnet	30
"	Sheep's Parsley	30
"	African Red-top	9 approx.

H. G. M.

No. 11.]

SOUTH AFRICAN ORNAMENTAL PLANTS.

There is a growing demand in Europe and America for seeds and bulbs of ornamental South African plants. We are often asked by correspondents abroad for the names of persons able and willing to collect special things, and shall be glad to know of any to whom we can refer them.

A correspondent in Ireland has recently written for seed of the purple-flowered *Dimorphotheca Barberiae*, a native of Kreli's country, which was introduced into the Royal Botanic Gardens, Kew, and flowered there in 1862, and was illustrated in the "Botanical Magazine," Vol. 88, Plate 5337. Our beautiful Transvaal species, *Dimorphotheca Ecklonis*, would probably be equally appreciated.

The species of Arctotis called Namaqua Marigolds are also asked for.

Correspondents in the United States and in England have been enquiring for "corns" of *Richardia Pentlandi*, a "Pig-lily" with bright yellow flowers and dark-green leaves *without* spots. This plant is said to grow on stony kopjies in Mapoch's Country, as well as in Basutoland.—J. BURTT-DAVY.

* * * *

No. 12.]

WATER PLANTS FOR CHECKING RIVER-FLOW.

A correspondent in the Wakkerstroom District asks, under date September, 1906, "Could the Government Botanist suggest a strong kind of water plant, similar say to the plant that forms the Sudd of the Nile, to be planted in African rivers to stop the seaward flow and raise their levels?"

I hesitate to recommend the introduction of such a plant as you describe, as it may prove a greater curse than blessing, and on account of the torrential character of our summer floods I doubt greatly whether we could get a plant that would ever succeed in checking the seaward flow and raising their levels.

The most likely plants for the purpose would be *Eichornia crassipes* and *Potamogeton pectinatus*. The latter is a native, and is causing great trouble in the lake at Germiston, making the rowing of pleasure boats almost impossible. If you want to try it, I feel sure that the Town Clerk of Germiston would be glad to send you a few roots, and to tell you what a nuisance it is. If it were effective I cannot see why it does not check the floods in our streams, as it occurs in many African rivers from the Zambesi southward, including tributaries of the Vaal.

The Eichornia may not be able to stand the cold of our High Veld winters, but it is worth trying. But great care should be taken not to introduce it on any irrigable stream; in Florida and Louisiana it has

done an enormous amount of damage to trade by making the streams impassable to freight boats.

You may possibly be able to obtain a root or two from the Director of the Botanic Gardens, Durban.—J. BURTT-DAVY.

* * * *

No. 13.]

EXTRACTED FOR THE "JOURNAL."

"Advised by the Department I got 50 lbs. Provence lucerne seed from a certain firm. Soil red loam, well cultivated; seed was sown on January 22nd and had good rains—nothing came up; on February 29th harrowed with tooth harrow—no result.

Ground ploughed in May and harrowed oats being sown on 25th. The 50 lbs. of Provence seed from another firm was sown by hand on the oats a week later; was irrigated once, and now lucerne is looking well, July 10th, in spite of heavy frosts.

Another 50 lbs. Provence lucerne seed from the same firm was sown on land adjoining this, hand sown and bush harrowed; came up well, and on April 10th was eaten down by locusts. We laid water on two days later, and it came on well again till May 26th when it was again eaten right down by locusts; it was then about 8 inches high. Water laid on again next day and lucerne seems to have quite recovered. My opinion is that March is the best month for sowing lucerne as there is less chance of the weeds overcoming it and the sun has less power."—H. P. DUKE, Witpoort, Potchefstroom.

"It may interest you to know that from the few roots of Paspalum which I got in Pretoria two years ago I have now about 14 acres sown from seed which I have collected, and I find that it grows readily from seed.

Cocksfoot and rye grass, New Zealand origin, is also doing well.

I am confident that in this district, with adequate shelter belts, we can grow English grasses well, and so convert the country from a brown veld into a green paddock during winter.

The few grasses I have named above are still green and look well in spite of a frost so heavy that my milk in the pans was solid this morning."—J. W. GRIMES, Florence, Lake Chrissie

* * * *

No. 14.]

NOTES TO ILLUSTRATIONS.

Plate CLXXXII.—Dodder on Lucerne Plant (*Cuscuta trifolii*).

Plate CLXXXIII.—Cracking of Apples due to fungus *Coniothecium chomatosporum*.

Plate CLXXXIV.—Anthracnose of the Watermelon caused by the fungus *Colletotrichum lagenarium*.

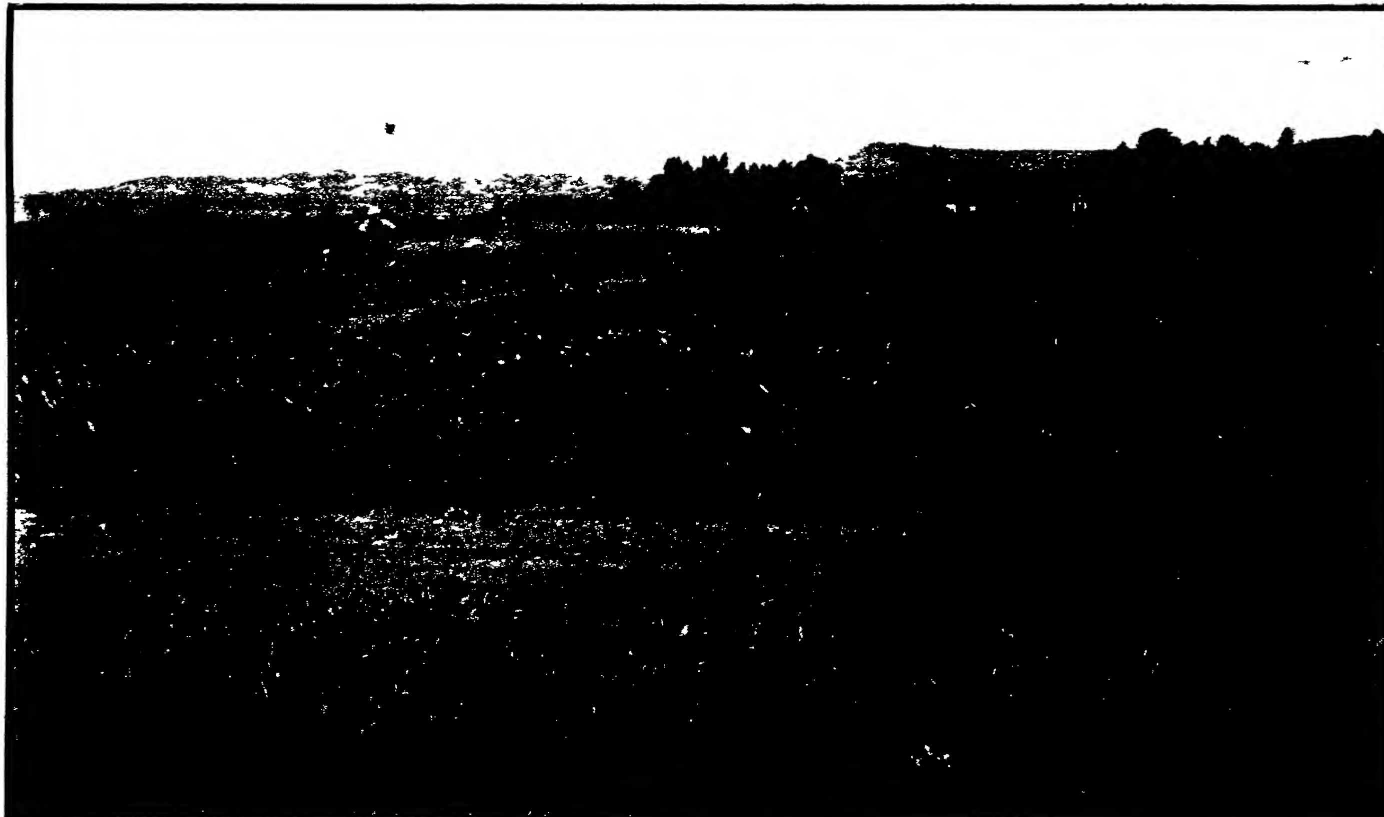


Plate CXCIV

Dry Land Experimental Plots.

Showing Pea Nuts in the foreground and Teosinte in the left hand upper corner

(Botanical Experiment Station Pretoria)

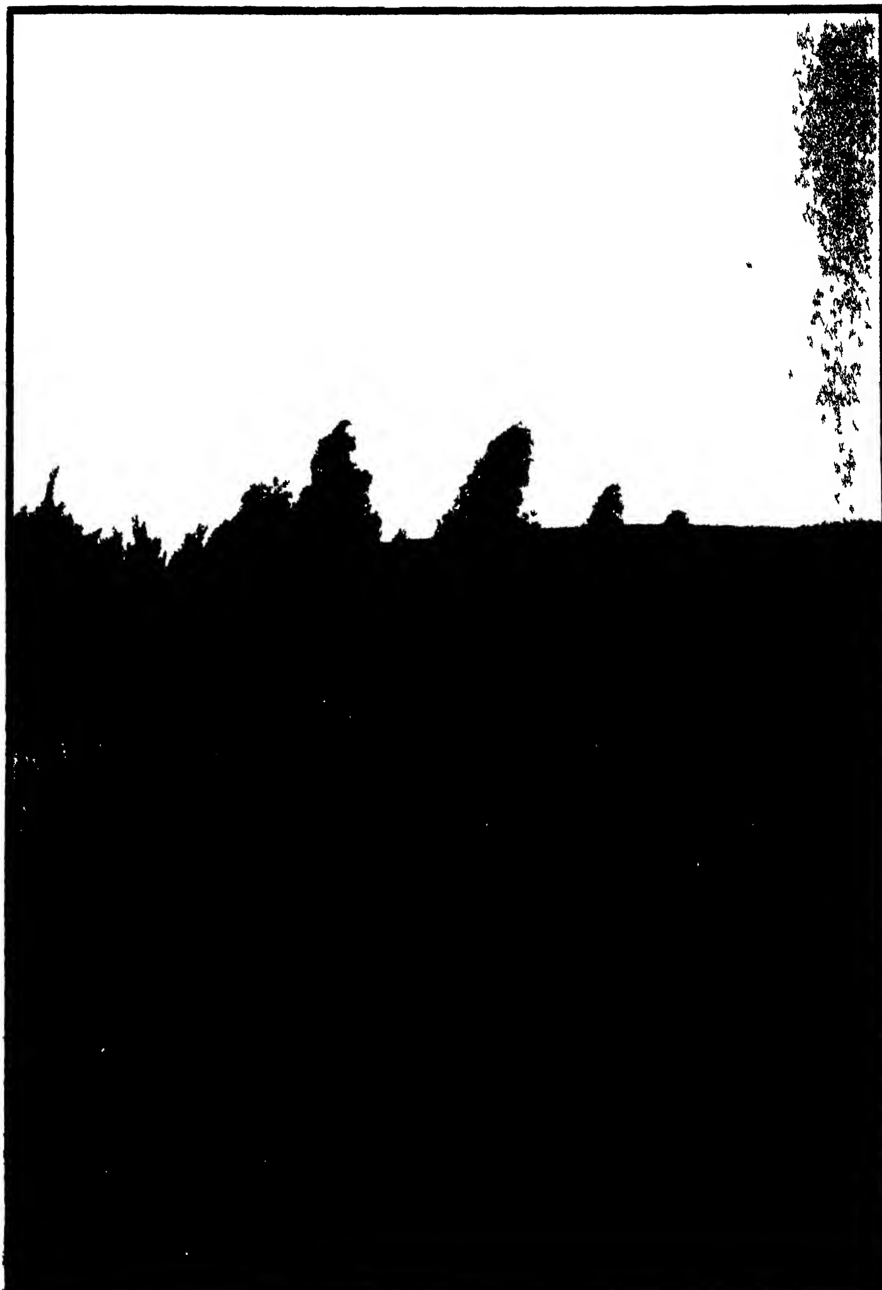


Plate CXCI

Tall Fescue

(*Festuca elatior*)

A fine winter pasture grass

Plate CXCVI

Dry Land Lucerne.

A good root taken from a three year old stand at the Botanical Experiment Station, Pretoria
(Photographed October, 1906.)

Plate CXCVII. **Effect of Veld Burning.**

Showing comparative growth.—(*A*) Mown the previous summer: (*B*) burned in the winter: (*C*) unburned and unmown. All show the new young growth. Note that (*C*) is longer than either (*A*) or (*B*).

Plate CLXXXV.—N.S. Wales Blue-grass (*Andropogon sericeus*). A 1-20th acre plot at the Government Experiment Station, Pretoria. The photograph was taken in January. In December the plot was cut for seed and when again cut in the middle of February it gave a green weight of 780 lbs., or at the rate of 7½ tons per acre.

Plate CLXXXVI.—Rhodes grass (*Chloris gayana*). One of best native hay grasses. This plot is two years old, and is now being grown for seed, otherwise two cuts could have been obtained this year.

Plate CLXXXVII.—Soybean (*Glycine hispida*). A good crop standing nearly 3 feet high. The seed was drilled in rows 3 feet apart; sown middle of November.

Plate CLXXXVIII.—Khaki weed (*Alternanthera echinata*), South America. A weed which is likely to become dangerous in the south-western districts. Very plentiful in the roads round Kimberley, Mafeking and Vryburg. Said by some farmers to be eaten by stock, but we have no evidence of this. Was proclaimed as a noxious weed in the above-named places, but has since been de-proclaimed in Vryburg.

Plate CLXXXIX.—Globe Amaranth or Bachelor's Button (*Gomphrena globosa*).

Plate CXC.—Japanese Millet, referred to in the article on "Millets for Hay."

Plate CXCI.—Golden Millet, referred to in the article on "Millets for Hay."

Plate CXCII.—Californian green moha, referred to in the article on "Millets for Hay."

Plate CXCIII.—Boer Manna, referred to in the article on "Millets for Hay."

Plate CXCIV.—Dryland Experiment Plots at the Botanical Experiment Station, Department of Agriculture, Pretoria, showing Pea-nuts (*Arachis hypogaea*) in the foreground.

Plate CXCV.—Tall Fescue (*Festuca elatior*). Another valuable imported winter grass, a native of Europe. Particularly well suited to the High Veld. Keeps green throughout the cold months and continues to make strong growth. Is inclined, however, to become "tussocky" unless kept closely grazed. Has also done well in a lawn grass mixture.

Plate CXCVI.—Root of Dry Land Lucerne.

Plate CXCVII.—Shows comparative growths made by grass, which has been—(*a*) mown the previous summer; (*b*) burned in the winter; (*c*) unburned. All show the new young growth, but on (*c*) the new growth is longer than on (*a*) and (*b*). The grasses are Andropogons from Sour Veld.

THE ENTOMOLOGICAL SECTION.

MOSQUITOS AND MALARIA.

BY C. W. HOWARD, B.A., Acting Entomologist.

For several years the lack of rain in the Transvaal has reduced the amount of malaria to a minimum, but the heavy rains of the present season will probably again cause a widespread epidemic of that disease. It is therefore advisable for all those living in malarial districts to take every possible precaution to protect themselves from infection.

The fact that malaria is transmitted by mosquitos belonging to the group *Anophelina*, has for a long time been so thoroughly proven that a discussion of those proofs is scarcely necessary. We need only mention the work done by this Division, along the eastern line of railway, two seasons ago, where, by screening the stations and cottages of the railway employees, and draining the pools where mosquitos bred, malaria was reduced more than 90 per cent. among these employees.

There are several objections frequently raised to the theory which can, however, be easily answered. It is frequently stated that people who have not been bitten by mosquitos contract malaria. Some people are less affected by mosquito bites than others, and such people might be bitten several times during the night and never know it. Besides, a relapse must not be confused with a new infection. The malarial parasite may remain in the blood for very long periods, and only cause trouble when something in the physical condition of the person allows it to increase in large numbers once more. The old idea that malaria is more prevalent in low, swampy regions, where vapours from the wet soil cause the disease, helps to prove the new theory. It is only in such wet low places that mosquitos can breed in abundance. Furthermore it was held that the disease was only contracted at night, when these vapours rose from the marshes; but it is only at night that the mosquitos fly about. Breaking up new ground, such as is done in the construction of new railway lines, is thought to cause malaria. When such ground is broken up, many places are produced which hold standing water, and thus serve as breeding places for mosquitos.

The organism which causes malaria belongs to the class *Protozoa*, small unicellular and usually microscopical creatures, the lowest form of animal life, and are not *Bacteria*, which are more closely allied to plants than animals. These parasites inhabit the red corpuscles in the blood of man. They appear at first as very small bodies, which grow until they completely fill the corpuscle. They then divide into several parts or spores, the wall of the corpuscle breaks, and these are set free in the blood. From a single infection this liberation occurs from all the infected corpuscles simultaneously, and causes the chill. There seems to be three types of parasites In the first (tertian malaria) the

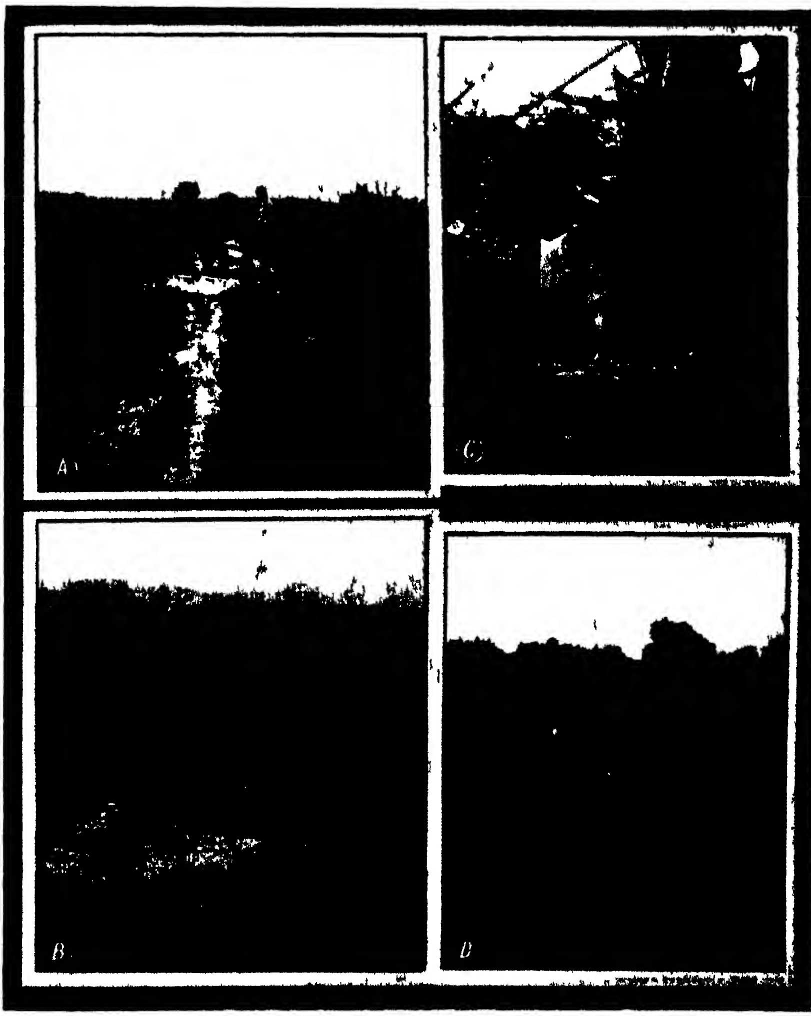


Plate CXCVIII

Typical Breeding Places of Mosquitos.

A and *B*—Anopheles breeding pools
C—Tins in which culex breed
D—A slum in a town where culex breed

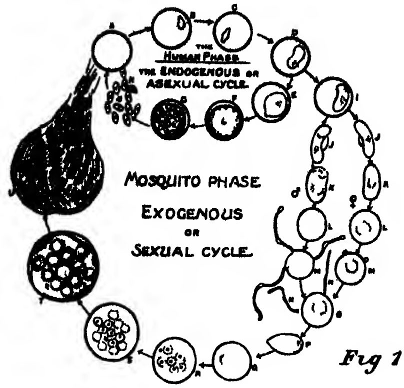


Fig 1

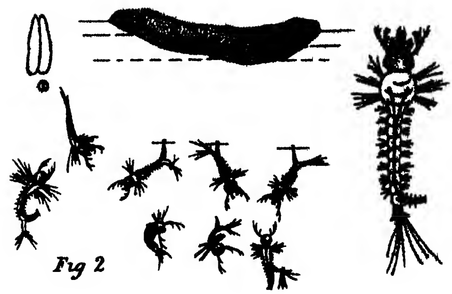


Fig 2

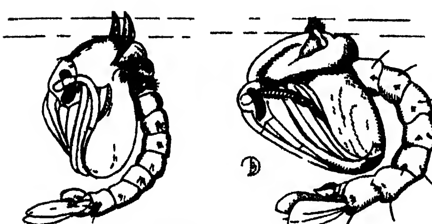


Fig 3

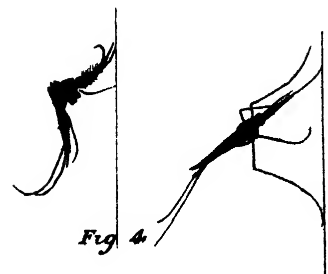


Fig 4

Fig 5

Fig 6

Plate CXCIX

FIG 1 —Scheme showing the human and mosquito cycles of the malarial parasite A, normal red blood corpuscle, B, C, D and E, red cells containing early stages of parasite; F, G and H, red cells containing spores; J′, K′, L′ and M′, male gametes; J″, K″, L″, M″ and O″, female gametes, P, Q, R, S, T and U, fertilised gamete or spore, showing its division into spindle-shaped bodies or blasts (After Manson)

FIG 2 —Eggs and larvæ of a Culex mosquito, enlarged eggs at left (From Howard's "Mosquitos")

FIG 3 —Pupa of Anopheles at right, of Culex at left (From Howard's "Mosquitos.")

FIG 4 —Adult Culex mosquito on left, Anopheles on right showing resting positions. (Original)

FIG 5 Culex larvæ on left Anopheles larva on right showing position in relation to surface of water when breathing. (Original.)

FIG 6 —Eggs of an Anopheles mosquito (From Howard's "Mosquitos")

sporulation occurs every two days, in the second (quartan malaria) it occurs every three days. The third is known as aestivo-autumnal or tropical malaria, and is by far the most dangerous. When the chill occurs every day there has been a double infection on different days.

Immediately upon the liberation of these spores in the blood they attack and destroy new red corpuscles, and may continue indefinitely in this round. But as soon as a drop of blood containing them is removed from the body they undergo a remarkable change; some become large and swollen, while others put out tail-like appendages which separate and fuse with those lacking the tails. These are called gametes, and constitute a true sexual stage, which will occur anywhere outside the human body, but only in the stomach of the Anopheles mosquitos will a further change occur. When it has reached the stomach of the mosquito the fertilized spore penetrates its walls and locates itself just under the surrounding layer of muscles, and then it increases to above five times its usual size and finally divides into a number of small spindle-shaped bodies called blasts. These are liberated through the muscular wall into the body cavity, and eventually find their way into the salivary glands of the mosquito, from which they pass into the proboscis, and thus into the next person bitten. Here the blasts once more enter into the red blood corpuscles and begin the life round anew.

Mosquitos belong to the class of insects known as *Diptera* or Two-Winged Flies, which possess only one pair of wings, and to the family known as *Culicidæ*. They are readily distinguished from the other flies by their small size, slender bodies, and especially by the rows of large scales along the veins and edges of the wings. The female has a large, stout, proboscis, while that of the male is very weak, and not fitted for sucking blood. The male is very easily distinguished from the female by the large feathery palpi on the front of his head, which act as ears for locating the position of the female when she sings.

All mosquitos are aquatic in their larval and pupal stages, but although living in water like fishes they do not breathe by means of gills as do fishes, but must come to the surface of the water for that purpose.

The female mosquito lays her eggs on the surface of the water during the night. From these hatch the larvae or wrigglers in from one to three days. These wrigglers are more or less cylindrical in shape, with a prominent tube on the tail end, the breathing tube. The little creature must come to the surface of the water and thrust this through the surface film in order to breathe. The food of these wrigglers consists of the micro-organisms and the decaying vegetable matter in the water, or in the case of a few species of their own kind.

Upon completing their growth they transform to pupae, which differ greatly from the larvae. There is a large rounded portion on which can be seen the outlines of head, legs and wings, and attached to it is a curved tail-like affair with two swimming paddles on the tip. Instead of the breathing tube at the tip of the abdomen, as was the case

in the larvae, there are now two trumpet-shaped horns on the top of the thorax, which take its place. The pupae do not feed, and remain quiescent except when alarmed and when necessary to breathe at the surface. From the pupae come the adults in a few days. In mid-summer the whole life history, from egg to adult, is passed in from ten day to two weeks. Mosquitos seldom fly long distances from their breeding places. The greatest distance can be safely put at three-quarters of a mile, but if a house is nearer at hand they will never go beyond it. Not even a strong wind will carry them any distance. They are very fragile in structure and weak fliers, consequently when a strong wind blows they always conceal themselves in grass or foliage until it is passed. A search should always be made for breeding places on the premises of an infested house before accusing one's neighbours of breeding the mosquitos.

The Anopheles, or malaria-carrying mosquitos, are easily distinguished from the Culex or non-malarial-carrying mosquitos. The adult Anopheles usually has spotted wings, while those of the Culex are plain and unspotted. The most typical characteristic, however, is the position which the mosquito takes when at rest. With Culex the thorax is humped, bringing the beak round nearly at right angles to the body, which is held parallel to the surface on which it is resting, whilst the Anopheles extends its beak straight out in a line with its body, and at a sharp angle to the surface on which it rests. In the pupa stage the difference is not so marked. The Culex pupa holds itself in a position more nearly perpendicular to the surface of the water. The Anopheles larvæ are surface breeders, and when breathing or feeding hold themselves parallel to the surface of the water, a thing more easily accomplished because of the short breathing tube. The eggs of Culex are laid in a raft-shaped mass, each with 200 or more eggs placed perpendicularly and finely glued together. This raft floats on the surface of the water, allowing the little ones to drop down as soon as hatched. The eggs of Anopheles are scattered singly. The two groups also differ in the character of places chosen for breeding. Culex choose any small temporary collection of stagnant water, such as may be found in buckets, old tins, water tanks, vases, and in pools in yards, or even in shallow streams. Anopheles choose pools of more permanent character, which are not liable to dry up soon or to be easily washed out by rain, and are seldom found in small vessels or pools of water ; such places usually occur in marshes, margins of rivers or ponds, badly drained roads, and unkempt back-yards. (Plates CXCVIII. and CXCIX.)

It is not only because of the danger of infection of malaria that we should undertake the destruction of mosquitos, but for our own happiness and comfort. There are three methods of combatting them, viz. :—

1. Destruction of adults.
2. Destruction of immature stages.
3. Prevention of bites of adults.

The first method is of little account, except in connection with the destruction of breeding places.

After a house has been screened or otherwise protected, it may be advisable to destroy the mosquitos inside by burning Keating's powder, sulphur, or more effectively by the use of hydrocyanic acid gas. If Keating's powder is used it only stupefies them, and they must be swept out, and destroyed as soon as they fall to the floor.

In the destruction of larvæ any measure toward the destruction of breeding places is effective. All buckets and old tins or broken crockery should be removed from the premises and buried, or so destroyed that they will hold no more water, small pools should be filled up with earth, all water tanks should be fitted with tight covers, and outlets fitted with very fine wire netting. Large water pools should be drained.

Perhaps the most useful and easily applied remedy is the use of paraffin on the surface of pools which can not be covered or drained. The paraffin being lighter in weight than the water, spreads out on the surface, forming a tough surface film. When the larvæ and pupæ come to the surface to breath they cannot thrust their breathing tubes through this surface film, and soon drown. The paraffin also destroys all eggs and all females when they come to oviposit. One ounce of paraffin will cover about fifteen square feet of surface. The heat, of course, causes it to evaporate, and it must be renewed in a week or ten days. It is not sufficient to merely pour the oil on the water, but it must be applied either by a spray pump or by wetting a bunch of rags in oil and sopping over the surface. Water tanks can be treated in the same way, provided that the water is drawn off from the bottom, so that the paraffin does not cause any taste.

With the above remedies a community can easily rid itself of mosquitos at a small cost. One energetic white man with one or two boys can do wonders in a couple of weeks by collecting all rubbish, such as tins and broken dishes in back yards, paraffining pools and tanks, and draining small pools in streets and town lands.

The third method of treatment, protection from bites of mosquitos, is often the only method practicable, especially in isolated places in malarial districts. There is no method which can be used with better results for such places than the screening of windows and doors with fine wire netting. Light frames can easily be constructed for doors and windows, on which has been stretched the wire netting. After the mosquito season they can be stored away until again needed. A verandah could be closed in with this netting, and thus provide a safe place to sit and enjoy the cool evening. These screens have the additional advantage of keeping out flies during the day time, but they are useless unless they are in good repair and always kept closed. Outbuildings should also be screened.

Along the same line is the use of bed nets. These cannot be too thoroughly recommended, provided they are used properly. They should be always in good condition with no holes, and well tucked in

round the bed. Mosquitos are very persistent, and sure to find the smallest entrance to the net.

Native huts should always be kept as far away from the habitation of white people as possible. Every native child has the malarial parasite in its blood, and serves as a source of infection for the white people about.

All malarial patients should be kept excluded from other people, in a mosquito-proof house, otherwise they will serve as a source of infection for a whole community. This is well illustrated in one of the coast towns in South Africa, which was practically free from malaria up to two or three years ago. Malaria patients were sent there to recuperate, and as a result of not isolating them, malaria is now very bad in that place.

In malarious districts it should always be remembered that in just the same proportion as you reduce the Anopheles mosquitos, or to just the amount that you protect yourself from their bites by just so much will you reduce the chances of contracting the disease.

* * * *

FUMIGATION OF CITRUS TREES WITH HYDROCYANIC ACID GAS.

By F. Thomsen.

In orchards, nurseries, and especially in orange plantations insect pests soon make their appearance. The group of scale insects causes the most trouble, and it is principally against these that the fumigation with hydrocyanic acid gas is used. Spraying will help to a certain extent, but in fumigation we have an inexpensive and easily handled remedy, to fight most insect pests of this class of trees. If fruit-growers and nurserymen would only recognise the benefit they may derive from fumigating their trees and greenhouses, I am sure the use of hydrocyanic acid gas would become more general.

It was in the eighties of last century that the cottony-cushion scale, locally called Australian Bug (*Icerya purchasi*), made its appearance in the citrus orchards of California, and was soon endangering the whole of the fruit culture of the Pacific Slope. As this was a serious matter the fruit growers in their despair asked for help from the Agricultural Department of the United States. The matter was taken up by the Division of Entomology, and Dr. Riley, then Entomologist, sent two assistants, Mr. D. W. Coquille and Mr. A. Koebele, to undertake the study of methods for the control of these insects.

To Mr. Colquillet belongs the credit of first experimenting with the hydrocyanic acid gas, by confining orange trees in an air tight space, and then filling the latter with gas generated from potassium

cyanide and sulphuric acid. Small orange trees were at first operated upon, but later tents and boxes were used to cover the larger trees. These experiments were made in the latter part of the year 1886. Since that time fumigation has been in use all over the world, with the very best results.

The chemicals used for the fumigation are :—

Potassium Cyanide,
Sulphuric Acid (commercial).

The Tents.—To confine the gas round the tree, a tent or sheet made of some air tight material must be used. Three kinds of tents are generally in use now, viz. : the frame tent, the hoop tent and the sheet. There have been several methods in use at one time or another, but it will be found that the above three kinds will answer all purposes.

The Frame Tent.—The frame tent comes mostly in use in orchards where the trees are not higher than five or six feet. It consists of a wooden frame six feet high by four feet wide each way. This is a very economical size, but naturally could be made smaller to suit younger trees. Every farmer can easily make one himself ; flooring boards ripped in two will answer the purpose, the boards are nailed at the corners, and the whole structure is covered with Russian duck or strong unbleached calico, and painted with either boiled linseed oil or ordinary paint. It is best to let a strip of the cloth, about twelve inches wide, hang free from the lower edge of this frame, so as to be able to cover earth around, in order to prevent the escape of gas from beneath. Two handles should be nailed across two sides of the frame, at about two feet from the lower end. This makes it easier to handle the box, or to carry it from tree to tree. It is also advisable to nail some fine meshed wire netting inside the top to prevent the thorns of the longer branches tearing through the cloth. The following Plates—CC., CCI., and CCII.—will explain the structure of the frame tent.

The Hoop Tent.—The hoop tent, as can be seen in the accompanying pictures, derives its name from an iron hoop made of gas piping, which varies in diameter with the size of the tent, and which runs through loops at the lower end of it about twelve to eighteen inches from the bottom. This hoop is best made in two sections, which can be unscrewed to allow of easy packing, for transporting the tent by wagon or rail.

The Plate No. CC. shows very clearly how this hoop helps to put the tent over the tree or to remove it. The hoop tent will be found very convenient when the orange trees are from eight to twelve feet high, with a diameter of about six or eight feet. The best material is a ten or twelve ounce duck. These tents can be bought ready for use in Johannesburg, at various prices. For the man with small means, a home-made tent will answer the purpose very well. Take a good stout unbleached calico 36 inches wide, cut into twelve strips fifteen feet long, have it sewn together with a double seam length-wise. When finished

this will form a huge bag open at both ends. Now lay this on a level floor, six strips being on top and six underneath. Have everything nice and smooth. Now begin at the lower corner on each side and cut along diagonal lines extending to the second seam from the edge on the upper side, thus removing a large triangle on each side. Reverse these two triangles so that the top comes at the bottom, sew them in place and close the narrow top with a double seam. The tent will now be very wide at the bottom, and narrow at the top, or rather bell shaped. Hoops can be stitched on at a foot from the bottom and a half-inch iron hoop passed through.

This tent can also be used without the hoop, by pulling it over the tree with two poles.

Before using, this calico tent must be dipped in boiled linseed oil, to which a very small quantity of castor oil has been added, and hung up loosely to dry, otherwise the linseed oil will oxidise and destroy the cloth. I have tried starch instead of linseed oil, this being somewhat cheaper, but found that the starch soon came off, and that the tent became far from air tight. With careful handling this kind of tent lasts a very long time. It will be found that in newly laid-out orchards, where the young citrus trees are either budded or grafted, the fumigation work will be much easier and less expensive. A budded or grafted tree remains much smaller and uniform of size, and would only require tents of one size. For trees larger than twelve feet an octagon sheet comes in use. It is made of ten ounce duck or in very large sheets eight ounce duck, to reduce the weight. The octagon shape has been adopted to lessen the cost, the four corners would be useless and can be dispensed with.

The sheet has to be laid on the ground along the tree well away from the outer branches. Two poles, which should be at least five feet longer than the tree to be fumigated is high, laying at right angles to the sheet, the two corners tied to the top end of the poles, just below this the guiding or pulling rope is attached. It is convenient to have this rope ½ inch thick, and about 20 or 25 feet long. Just in front of the bottom end of the poles a small hole is dug to slide the poles in and prevent them from slipping. Two men take hold of the poles and two others of the ends of the guiding ropes. The ropes are pulled steadily and evenly outward and forwards, while the other two men support the poles, and see that they do not slide out of the holes. A fifth man stands by the sheet to see that it comes up clear of the branches. In this way a large sheet can easily be lowered over the tree.

Sheets of very large size, such as forty feet square or more, are hoisted in a similar way, with the addition of two guy ropes to each pole and a pulley. The Plates No. CCI. and CCII. will show the position. Two poles are laid on the ground well away from the tree, the tops are connected with a rope, which should have the same length as one side of the sheet, two guy ropes and a pulley are then fastened to each pole, and a half-inch rope is run from each corner of the sheet through the pulleys. The poles are hoisted by aid of the guy ropes,

and the sheet pulled up by means of the half-inch rope. The sheet is hanging straight at one side of the tree, it can now easily be pulled over, a slight wind blowing into the sheet will greatly facilitate the work. In a strong wind the sheet cannot be manipulated.

Quantities of Chemicals recommended for the fumigation of *Citrus Trees* :—

GENERAL STATEMENT OF QUANTITIES.

Height	Diameter	Water	Acid	Cyanide	Space enclosed by sheet
Feet	Feet	Fluid ozs.	Fluid ozs.	ozs.	Cubic feet
4	3	1½	½	½	25
6	4	2	½	½	65
6	6	3	1	1	140
8	6	5	1½	1½	200
10	8	8	2½	2½	435
12	8	9	3	3	535
12	10	10	3½	3½	815
14	10	12	4	4	970
14	12	15	5	5	1 355
16	12	18	6	6	1,585
16	14	23	7½	7½	2,105
18	14	24	8	8	2 415
18	16	30	10	10	3 085
20	16	33	11	11	3,485
20	18	39	13	13	4,325
22	18	45	15	15	4 835
24	20	60	20	20	6,500

A little more water could be added than is shown in the above table. For frame tents the necessary amount of cyanide, sulphuric acid and water could be figured out on the scale of 1 oz. cyanide of potassium, 1 fluid oz. of sulphuric acid, 3 or 4 ozs. of water for every 300 cubic feet of space for citrus trees.

The Chemicals.—By practical experience I found that the best and easiest way of using the chemicals is as follows :—

Use an enamelled dish (ordinary tin would soon become useless), have it rather large to prevent boiling over. First put in the water, then add the sulphuric acid—water should never be poured into the acid, intense heat is created and the hands and clothing are ruined by the sputtering of the acid. Put the dish in position under the tent and well under the enclosed tree, gently drop in the necessary amount of cyanide of potassium, which ought to be kept ready in a paper bag, drop in bag and all and the acid will soon enter, close down the tent and heap earth all round the base. Now leave the tree under the influence of the gas for forty-five minutes or one hour, but not longer or the tree will be burned. When removing the tent be careful to lift one side

first in order to get good ventilation, and to allow the gas to escape. Stand so that the wind blows from you. The hydrocyanic acid gas is highly poisonous, and none should be inhaled.

For ordinary orchard work, one white man and two natives can easily handle ten tents, that is if the trees are of uniform size. When the last tent is in position and charged, enough time will have elapsed to take down the first tent again. It is advisable to have a bucket of water and all chemicals in a handy box so that one man can carry this from tree to tree. A stout apron made of some sail cloth, and a pair of old gloves will be found serviceable, as the acid soon comes in contact with hands and clothing. Should some of the sulphuric acid get on to any of the fingers, dip them at once into the water. This chemical will not alone discolour the skin, but will also leave nasty burns. People with tender skins should have a tin with water, to which has been added a little ammonia, close at hand. A long-handled enamelled ladle, marked inside for ½ and 1 fluid ounces will be found the best for measuring the acid.

The cyanide of potassium should be powdered rather fine, weighed at the house, and put into small paper bags. Half ounce and one ounce parcels will be found the most convenient. Great care is necessary in handling cyanide, as it is a strong poison. When pounding it up use a strong canvas, fold it double, put the lump of cyanide inside, and use a broad hammer, or flat piece of iron to crush it. Be careful that none of the small pieces fall outside, as fowls are very fond of picking these up, and would naturally be dead in a few minutes. Should any of the cyanide be spilled about pour a large quantity of water on the spot, this will dissolve the small pieces. Don't make more cyanide parcels than are required for one working. This chemical takes up a good deal of moisture, and the paper bag will soon be broken.

There are several things which have to be observed in fumigating trees and plants. Deciduous trees, such as peaches, plums, apples, etc., can only be fumigated in the winter months, after the leaves have dropped off, otherwise the fumes would scorch the leaves. Citrus trees can be fumigated either in winter or summer, but not when the tree is blooming, and not in the hotter part of the day. The sun shining on the tent brings the temperature inside to such a height that the leaves, and especially the younger shoots, will become scorched and die off. Fumigation work should be done at night time, and the best season is after the first spring rains, that would be from October to December ; the young fruit is set then, and the insect life at its best. The young scales have hatched out, and will soon be affected by the poisonous fumes. Don't fumigate on windy nights. Don't have any rain drops or heavy dew on the leaves, as the hydrocyanic gas is taken up by the water and burns holes into the leaves.

After the tent has been removed from the tree, a residue will be found in the dish ; this consists of potassium sulphate, and perhaps a little sulphuric acid. This residue must be buried under the tree in a good place. It is a splendid fertilizer.

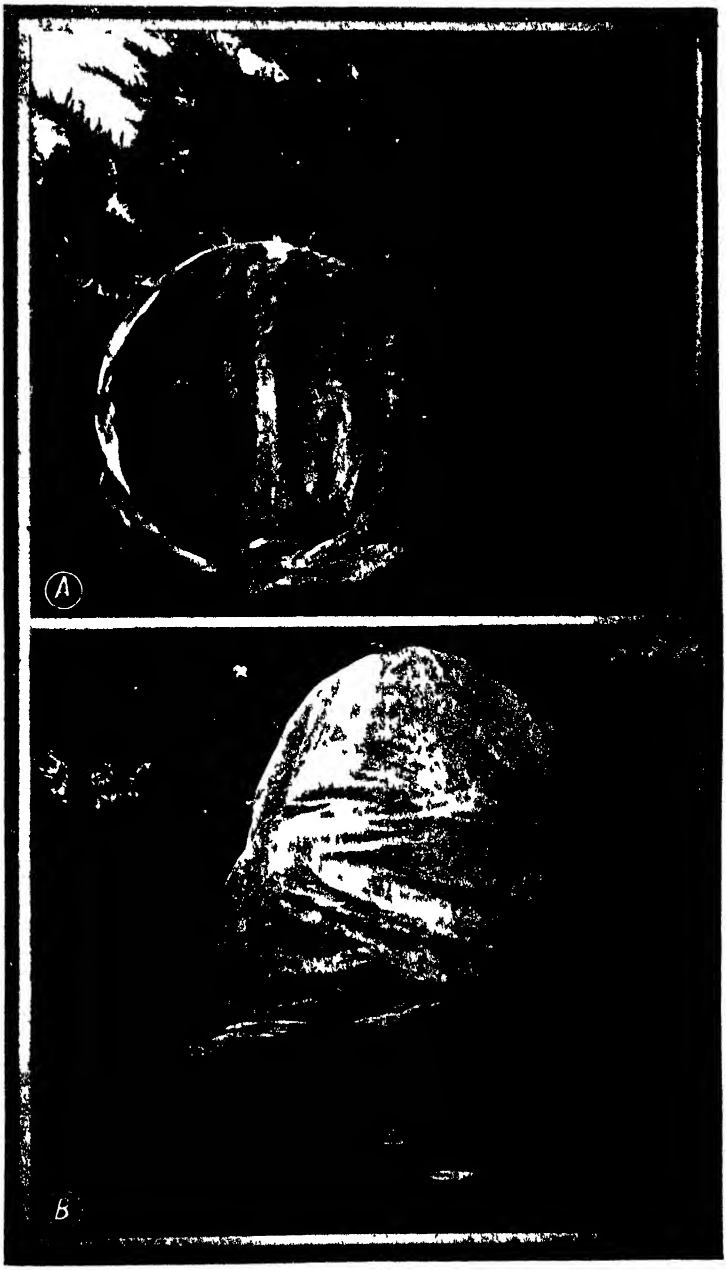


Plate CC **Fumigation Tents.**

A.—Ready to place in position

B.—In position and putting the charge of cyanide in the dish

Plate CCI

Fumigation Sheet.

Sheet being placed over tree

Plate CCII

Fumigation Sheet.

Sheet in position over tree and charge applied

In fumigating other plants than deciduous and citrus trees great care must be observed, herbaceous plants with fleshy leaves, ferns and palms are very tender and much smaller quantities have to be employed. When the work is done the tents or sheets should be stored away in a safe place; the white ants or a strong wind might do damage. This Division is stocking cyanide of potassium, and will supply *bona fide* farmers and fruit growers at cost price. The sulphuric acid and ready-made hoop tents and sheets have to be purchased elsewhere. Intending buyers can have the names of the firms who sell these articles on application to the Government Entomologist, Box 434, Pretoria.

THE HORTICULTURAL SECTION.

FRUIT TREES FOR SALE AT THE GOVERNMENT EXPERIMENTAL ORCHARD, POTCHEFSTROOM.

By R. A. Davis, Horticulturist.

Last year this notice unfortunately appeared under the heading of "Potchefstroom Experimental Farm." The consequence was that many orders were sent to the general manager of the farm and were transmitted by him in due course to the Horticulturist. The delay thus caused resulted in some cases in the disappointment of applicants owing to certain varieties ordered being sold out in the meantime. In order that this may not occur again it is requested that *all orders for fruit trees* for delivery in July next be sent without exception to the Government Horticulturist, Department of Agriculture, Pretoria. *No order* will be booked before May 1st. This date is mentioned in order that all recipients of this "Journal" may be duly informed beforehand of the trees available. On and after that date orders will be accepted strictly in rotation for not more than 250 trees from any individual.

The trees are all grown and budded in the nursery at Potchefstroom, and are true to name. Price 1s. each, excepting apples which are on blight-proof stocks. These are 1s. 3d. each. Payment to be made on receipt of trees by cheque or post office order to the Assistant Horticulturist, Potchefstroom, to whom *all remittances* should be sent. Cheques, etc., to be crossed "National Bank of South Africa."

It is requested that growers in and near Potchefstroom, who delayed sending in their orders last year, and were in consequence unable to secure trees, will pass in their requirements as soon after May 1st as possible.

Delivery of trees will take place f.o.r. Potchefstroom during the month of July.

Apples.

124 Baldwin.
83 Shockley.
87 London Pippin.
46 Irish Peach.
99 Lord Wolseley.
86 Rymer.
112 Nickajack.
99 Lord Suffield.
92 Jonathan.
20 Bramley's Seedling.
103 Ben Davis.
112 Rome Beauty.
91 Cleopatra.
95 White Winter Pearmain.
61 Nonpareil Russet.
63 Wemner's Hock.
34 Versveld.
82 Ohenimuri.
82 Reinette de Canada.
35 Cellini.

Apples.—(Continued.)

34 Scotch Bridget.
36 Northern Greening.
10 Wellington.
13 Allington Pippin.
20 Early Victoria.
106 Rhode Island Greening.
29 Ribston Pippin.
44 Blenheim Orange.
69 King of Tomkin's County.
75 Cox's Orange Pippin.
104 Stone Pippin.
107 Red Astrachan.

Pears.

35 Keiffer.
7 Idaho.
26 Beurre Hardy.
12 Seckal.

Japanese Plums.

70 Chalcot.
74 October Purple.
84 Wickson.
81 Hatankio Maru.
86 Ogon Nagate.
75 Satsuma.
63 Abundance.
61 Kelsey.
4 Masu.

Peaches.

24 Apricot.
92 Royal George.
80 Dr. Hogg.
60 Abec.
42 Muir.
57 Gladstone.
48 Brigg's Red May.
45 Bethesda.
51 Belle Baume.
40 Constantia Freestone.
7 Angel.
14 Waldo.
15 Pallas.
18 Peen-to.

Nectarines.

42 Victoria.
52 Stanwick Elruge.
32 Albert Victor.
29 Improved Downton.
39 Early Rivers.
41 Milton.

Apricots.

58 Bush Peach.
92 Orange.
69 Precoce de Holland.
4 Prince's Orange.
4 Early English.
64 Royal.
67 McLeas Late.
52 Early Cape.
67 Victoria.
95 Blenheim.
82 November.

Prunes.

116 Prune d'Agen.
27 Sugar.
36 Oregon.

SCIONS FOR BUDDING AND GRAFTING PURPOSES.

The distribution of Scions will take place at any time during the months of February and July. A charge of 1d. per cutting approximately 12 inches in length will be made, and post or railage charges must be defrayed.

Scions of the following varieties are available :—

Apples.

Rome Beauty.	Ohenimuri.
Red Astrachan.	Beauty of Bath.
Stone Pippin.	Lord Suffield.
Reinette de Canada.	Shockley.
Gravenstein.	Ben Davis.
Jonathan.	

Apricots.

Royal.	Orange.
Blenheim.	Early Cape.
Moorpark.	

Pears.

Louise Bonne de Jersey.	St. Germain.
Beurre Diel.	Duchess d'Angoulleme.
Vicar of Winkfield.	Glout Morceau.
Keiffer.	Easter Beurre.
Bon Chretien.	

Nectarines.

Stanwick Elruge.	Albert Victor.
Victoria.	Rivers Orange.

Cherries.

St. Margaret.	Monstreuse de Mezel.
Emperor Francis.	

Peaches.

Elberta.	Constantia Free.
Dr. Hogg.	Belle Baume.
Abec.	Bethesda.

Jap Plums.

Kelsey.	Chabot.
Wickson.	Shiro Smomo.
Burbank.	Satsuma.

Prunes.

French Prune (Prune d'Agen).	German Prune.

Vines.

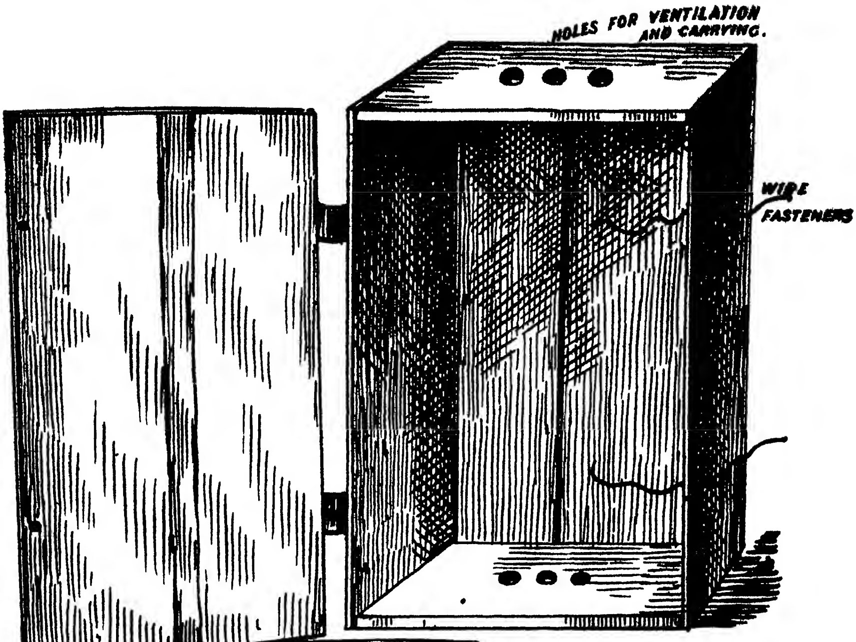
A limited number of cuttings of Grape Vines will be available at 1s. per dozen.

Resistant Vines.

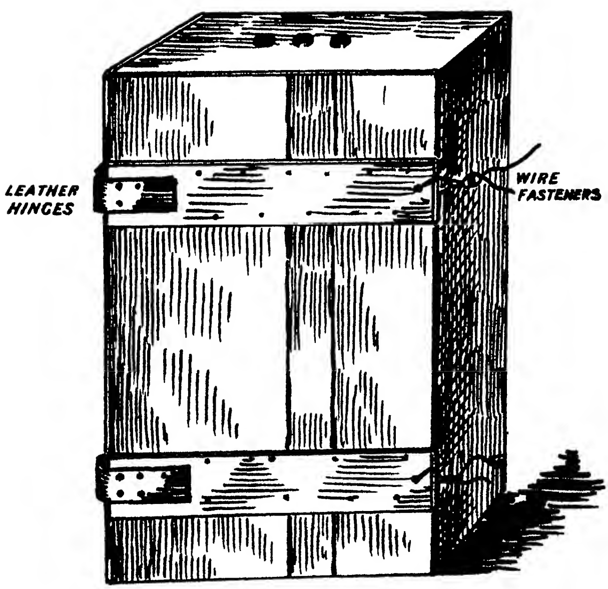
Cuttings of

Aramon Rupestris.	Riparia Gloire de Montpelier.
Rupestris Metallica.	Jaquez.

may be had at 20/- per 1,000. These vines are non-bearers, and only of use for stocks on which to graft other varieties.



BOX OPEN.



BOX CLOSED.

Plate CCIIa.

A Home-made Orange Box.

PACKING OF ORANGES FOR LOCAL MARKETS.

By R. A. Davis, Horticulturist.

The advent of the railroad in our orange-producing districts has sounded the death knell of the old-time custom of sending this fruit to market. The practice of utilising the bed of a wagon as a means of transport had doubtless its advantages in that formerly the cost of carriage by such means from producer to consumer was so little as to amount to practically nothing. The disadvantages were also apparent in the bruised condition of the fruit on its arrival at the market. This materially interfered with its keeping qualities, and prohibited large purchases by dealers owing to the extreme liability to decay manifested by fruit arriving in such a state. It is impossible to expect a railway to accept consignments of fruit loose ; therefore it must be placed in packages of some kind to ensure easy and quick handling both at the shipping point, and upon arrival at its destination. The question then arises as to the best and most economical package to use for the purpose. It is true that sacks have been previously largely employed during the days of ox-wagon transport, but sacks of ordinary size are too large and heavy to admit of careful handling. Usually they are thrown about in a manner utterly regardless of the value or delicacy of their contents, the consequence being that this method of packing has been little if any better than sending the oranges to market loose. Smaller sized sacks are open to a similar objection, the likelihood of piling half-a-dozen one on top of the other is always present, and in such a case the state of the fruit in the bottom sack is easily imaginable. There appears to be only one solution of this problem, and that is the use of some kind of box. Recently there has been going round in some of the Colonial agricultural journals a series of diagrams of orange boxes showing just how and how many to pack in a box. These, however, are entirely for the export trade. Such boxes landed in Pretoria would cost at least 1s. 3d. to 1s. 6d., and in addition they would be non-returnable, and the cost of the boxes would have to be deducted from the gross returns of the fruit sales. If long distances had to be traversed, the adoption of these boxes in the Transvaal might be justifiable, seeing that on an average the cost of such boxing would only run to possibly 8d. or 9d. per 100—depending on the size of the fruit. The extra good condition on arrival would possibly more than recompense the grower for the outlay, but the constantly recurring need for the purchase of new boxes would be looked upon with a feeling of dismay, and the need of something better suited for local use and the handling of comparatively speaking small quantities of fruit would surely be felt.

It is to meet this need that the present article is written. If the writer were not well assured that non-returnable orange boxes would not meet the needs of farmers at present, and for some few years to come, he would at once recommend the adoption of the standard orange

boxes as used in large exporting countries. When the time comes, as it will, that the Transvaal can export citrus fruits oversea, it will be early enough to urge the adoption of this package.

It has been found in Cape Colony, where a state of affairs somewhat similar to that existing here, is present, that it is a good plan for each individual farmer to go in for a certain kind of box or basket and stick to it. The boxes adopted should be uniform in size, not too large, strong and well made to stand the rough usage of native railway employees.

In some cases it has been possible for a farmer to make boxes from wood grown and sawn on his own place. This, however, does not frequently happen. It is far more common to find paraffin or whisky cases turned to account, and either of these may be made over into a very useful orange carrier. In order to accomplish this, a little alteration is necessary. One side of the box is removed and used as a lid. It may be attached either with straps of leather or wire as hinges, and fastened on, closing with lengths of wire passed through holes close to the edge of the cover and front of the box. The ends of the wire are drawn together and twisted in such a manner as to render any attempt at opening (except with a pair of nippers) a tedious operation, such as would not be acceptable to casual fruit pilferers. In order to recognise these boxes quickly and easily as is sometimes necessary when one has to examine a large pile of returned empties, the property of many various owners, it is well to distinguish boxes by painting the ends with some distinctive colour, and also to stencil the owner's initials or name in full on these painted ends in white or some other colour which will show up boldly. Both paraffin and whisky cases are plentiful and cheap. The life of one of them used as an orange carrier may sometimes extend to a couple of seasons so that these make really effective and inexpensive packages. Address cards should be nailed on the top of each package, unless it is the custom to send fruit exclusively and continuously to one agent, in which case it may save time and labour to have the name of the latter stencilled or painted on. A card should, in each and every case, be affixed, stating the number and variety of fruits contained in the particular box on which it is placed. It is perhaps unnecessary for our local markets to wrap each fruit in paper, but this practice should be observed when choice fruit is sent. Buyers expect fruit which is so wrapped to *be* really choice, so that it would be a mistake to wrap anything in the way of second-rate or scaly fruit, as it would decidedly damage the reputation of the sender. Too much care cannot be given to the actual packing of the fruit, either wrapped or otherwise. Each orange should be placed, not thrown into, the box ; the packing should be firm, and the fruit should be placed so that it may need slight pressure to enable the lid to close down. This is necessary to ensure safe travelling, the great object being to avoid shaking about in the box. Oranges—in fact all citrus fruits—may be kept for a few days with advantage before packing. All fruits, no matter of what kind, shrink in bulk after being packed. If a little of

this shrinkage takes place before packing there is the less liability to become loose in the box and shake about in transit.

Naartjes should not be packed in cases as large as those used for oranges. If returnable boxes are decided on then whisky cases are better than larger ones. It is a fact, however, that naartjes often fetch better prices than oranges, and such being the case it may pay growers to decide on some small cheap package non-returnable. Such are now to be had of Messrs. Mosenthal & Co., of Pretoria, capable of holding a couple of dozen fruits in a single layer, or twice that number, or thereabouts, in a double layer box. Packing in neat and regular order, and wrapping of special fruit is sure to bring increased returns. The same practice with regard to particulars of the contents of each box as advised for oranges should be observed, and care should be taken specially that correct numbers are given. Rough lemons may be sent in similar cases to oranges. The better quality fruits of this kind, of which unfortunately there is such a scarcity at present, are better sent in smaller boxes.

The question of utilizing baskets has still to be considered. A vast number of these, containing imported eggs, find their way to the Transvaal monthly, and these have in some cases been used as orange carriers. The basket is too well known to need description here. It should be sufficient to say that it holds from 80 to 120 oranges, and that the price is, roughly speaking, about 2s. each. The baskets are oblong and rectangular, and are readily accepted on all railways, which, by the way, strongly object to round packages in any form. The latter take up more room than square packages, and are not desirable from many points of view. It may be possible that the Spelonken natives could turn out similar baskets at the same or even at a lower price, in which case the prospects of a small industry arising in this direction are worth considering. Illustrations of a paraffin case converted into an orange carrier are given (see Plate CCIIa.), and samples of these may be seen at any time at the office of the Government Horticulturist, Pretoria. It must be thoroughly understood that the foregoing remarks apply to local business only.

* * * *

TRANSVAAL FRUIT GROWERS' ASSOCIATION.

By R. A. Davis, Horticulturist.

It appears to the writer that such an institution as the above would be of the greatest benefit. At present there is but one association of the kind in existence in the Colony, *i.e.*, that at Potgietersrust. If kindred societies were instituted in the different citrus growing districts of the Transvaal only, the benefits to growers would be considerable. If the movement included growers of deciduous fruits, naturally the influence would be still greater. The lines of the Transvaal

Agricultural Union might be adopted with advantage, *i.e.*, District Associations in the various sections of the country where fruit-growing is, or is likely to become, an industry with one Central Society composed of delegates from the various districts.

Such Associations are at present in good working order in Cape Colony, both in the Eastern and Western Provinces, and the members take care that resolutions passed by them in Congress are brought to the notice of, and are where possible acted upon, by the Agricultural Department of the Government. Many questions which should be decided by the growers themselves have hitherto in the Transvaal been dealt with departmentally, and the following letter falls under such a category. It is a copy of Mr. Lewis Atkinson's remarks with regard to a proposed further exhibition of Transvaal citrus fruits in London in June next :—" Captain Bam is very desirous, in spite of the fact that the Exhibition is the most unfortunate date for your fruit, he will see if it would not be possible for the Royal Horticultural Society to appoint some date to make a special exhibition of Transvaal fruit. Their next Colonial Fruit Show is on the 13th and 14th June. Would these dates suit you, or would you wish it to be at an earlier date, and if you would kindly let us know at your earliest convenience. We will try and make arrangements with the Royal Horticultural Society to meet you on that date, so that you may make a thoroughly good show of Transvaal fruits and to advertise it well to the general public, as Captain Bam is most anxious to do everything he possibly can to further the interests of the Transvaal, not only during our present Exhibition, but at any other exhibition, and personally I should be only too pleased to assist him in any way possible."

Mr. Atkinson is the secretary of the South African Products Exhibition now being so largely attended in London.

If Fruit Growers' Associations were in existence here the letter could be dealt with at once. As it is, the secretary of the Transvaal Agricultural Union has been consulted on the subject, and what may be done in the matter remains to be seen.

Last June this Colony made a good show of citrus fruits and was successful in securing the highest awards offered. Our exhibit was, however, sent largely in order to feel the home market as to what fruits and what varieties were likely to prove acceptable as imports, and also to let our growers see just what position they occupied as regards ability to raise first-class oranges in competition with other Colonies. This double object has been served, and now the quality of our fruit having been demonstrated, and the Home requirements ascertained, it remains for our growers to lay themselves out to supply the existing demand. The writer does not see that any good purpose would be served by a further exhibition in June next. Such shows are really advertisements on a large scale, and as we have no wares to dispose of (being unable to supply our own markets at present) it does not seem to be wise to advertise that which we have not for sale.

However, the matter, as stated, has been passed on to the

Transvaal Agricultural Union, and if it is decided to make a further exhibit in June next, steps will be taken to notify every grower, so that a creditable display may be made.

* * * *

MORTALITY AMONGST CHERRY TREES.

A good many complaints have reached this office as to the dying of cherry trees. Most of them come from the High Veld, where climatic conditions are favourable to the growth of this fruit. In no case, however, has the writer mentioned the kind of soil in which the dead trees were standing, and herein lies one-half of the question. The other half is the rainfall and water supply. The cherry demands and, if good results are to be obtained, must have a deep, well-drained soil. Twelve feet deep is as little as is advisable, although success has been occasionally obtained with less. If a light loam underlaid with a gravelly bed is selected, little, if any, danger exists of losing a single tree. On the other hand, should such a top soil be underlaid with a stiff heavy clay, the death of all cherry trees planted is inevitable in a year like the present, when copious rains have been general.

Cherries are invariably budded on cherry roots, and these roots are perhaps more impatient of wet than any others. Standing water around them is fatal. On the other hand, a certain amount of moisture is necessary, and this fact necessitates the use of the utmost care in the selection of a site for cherry planting. Moderate moisture is essential, and may be maintained in seasons having a rainfall of 25 to 30 inches by cultivation of the land. If rainfall is absent, recourse should be had to irrigation, especially just after the fruit has been picked and previous to blossoming. The addition of water after cropping is attended with marvellous results. As a rule, the trees are injured to a certain extent by the pickers; here and there a broken branch may be seen, and a dejected appearance all round is easily distinguishable. A slight irrigation in case of no rainfall appearing completely alters the appearance of things, and trees which looked poverty-stricken and sad brighten up and assume every appearance of vigorous health. Too dry a situation is almost as fatal as one which is too wet, but it is a rare occurrence to find a large mortality from this cause. There is no doubt that the exceptionally heavy rains, coupled perhaps with unsuitable sites, are the cause of the death of many cherry trees this season.

Reference was made last year, in a short bulletin issued by this Division, to the soil and conditions needed if success is to be obtained. Trees planted previously, and without attention to special requirement, have, in most instances, been the greatest sufferers. Given suitable soil, drainage and water supply, the cooler parts of the Transvaal should be able to give a good account of the cherry business. —(R. A. Davis.)

THE POULTRY SECTION.

NOTES ON FOWL TICKS.

By Reginald Bourlay, Government Poultry Expert.

There is perhaps no pest in South Africa which is responsible for more deaths amongst poultry than the tick which is erroneously known in this country as the "tampan." One frequently hears that Mr. A. has lost all of his birds from "fowl sickness," but apparently no effort is made to discover the cause of death beyond holding a few post-mortems, which generally reveal little or nothing beyond the fact that the body is strangely devoid of blood. Several cases of this description have been brought to our notice during the past few months, and in each instance where we have had the good fortune to be able to personally inspect the premises we have found that fowl ticks were the source of trouble. Unfortunately, one is not, as a rule, told of such cases until the damage is done, or it would have been possible to save the majority of the stock.

The symptoms vary considerably, in some instances, and these are generally when the roosts are swarming with ticks, birds which are to all appearances healthy at night are found dead in the morning, as many as 20 being killed in a single night.

In other cases where the fowl ticks are not in such force, it is observed that the birds appear to be mopy and listless, refusing food and frequently affected with diarrhoea ; occasionally they will be found to be partially paralysed, having lost the use of either one or both legs. The presence of diarrhoea often leads the poultry-keeper to attribute the cause of trouble to enteritis or cholera, and this idea is frequently strengthened by the suddenness of death.

It is worthy of note that heavy losses from ticks usually occur during the earlier part of the summer, and this has led many poultry-keepers to think that the young grass has had an injurious effect on the system, and been the cause of death, the explanation being, we believe, in the fact that during the winter months these ticks lie dormant, but with the advent of the warmer weather they wake up and commence to feed. Fowls can frequently be kept in a tick infested house during the colder months of the year without suffering any ill effects, but directly the warm weather arrives the trouble commences.

Fowl ticks do not live on the bodies of poultry as do lice, but follow the habits of the red mite and secret themselves in the cracks and crevices of the fowl-house, where they lie hidden during the daytime, only emerging at night, when they fasten themselves on to the fowl and suck the blood. An adult tick seems to be capable of obtaining as much blood as it requires in a few hours and drops off at

the first appearance of dawn and hides itself, but the young ticks do not seem to be able to satisfy themselves so quickly, and will frequently remain on the birds for several days ; it is wonderful what an enormous amount of blood a quantity of these pests will draw out of a fowl's system in a single night for, as stated before, we have frequently examined dead birds and found the whole body bloodless.

"It is not only in dirty and ill-kept fowlhouses that ticks are found, but also in houses which are kept sweet and clean, for whitewash does not appear to have the slightest effect on them.* Last June we were asked to look at some birds belonging to a lady who was a great enthusiast, and who took care that the house was cleaned out every day and whitewashed every month ; she had lost several birds during the previous summer without being able to discover any cause, but mentioned that on opening one of the birds she had noticed that it did not appear to have a drop of blood in it. As stated, the house was very clean and well kept, but on moving some loose woodwork the cause was very apparent, for there were little colonies of ticks in hiding. In this case they had evidently been imported in a frame of perches which had been purchased at a sale some months before. It is often puzzling how they get into a yard, but when we say that we have shot sparrows and doves which have had young ticks on them it will readily be understood that no poultry house—however well kept—can be sure of immunity. Another common source of infection is through buying fowls on the open market, for many of these have been sent in by country storekeepers who have bought them from Kaffirs ; these birds are usually kept for a time in a run at the store until there are enough to send away, and there are very few such runs which are not infected.

Yet another source of infection is, we are sorry to say, the railway, though in justice it is only fair to say that we do not see how this can be obviated, some of the trucks and vans are undoubtedly infected with ticks, which have come out of crates or boxes of fowls at some time or another, and have secreted themselves in the crevices of the vans ; they have probably been starved for months owing to the trucks being used for other purposes, but as soon as they have the opportunity they take advantage of it, and thus carry the infection further

When buying birds on the market it is wise to make them roost at night in a packing case or some similar article of little value for 10 days or so, after which they may safely be allowed to use the fowl-house, and the packing case should then be burnt.

There are several ingenious inventions for guarding poultry from the attacks of these pests, the two more noteworthy being as follows :—

1. The suspension of the perches by strong thin wires from the

* Mr Howard the Acting Government Entomologist, whose timely article on "Two little-known Ticks" appears in this issue, informs me that he considers that whitewash properly applied, viz hot and thick, is a good preventive, provided care is taken not to introduce ticks from outside Further, Mr Howard states that the ticks on doves and sparrows might have been of another species, as there are several common South African ticks which attack birds either in the immature or adult stage —R B

roof of the house with side wires to prevent the ends of the perches from coming into contact with the sides of the house; the wires are covered with moist tar or some other sticky substance which will effectually prevent the ticks from walking along it.

2. Roost hangers, which are metal supports fitted with a cup in the centre, this cup must be kept full of paraffine or some other preparation which is deadly to the tick, one end of the support is fitted into the side of the fowl-house, the other passing through a hole in the perch made for the purpose, the cup is about half-way between the side of the house and the perch, and to get to the bird the tick has to get over its contents. Unfortunately neither of these methods make provision for preventing the ticks from dropping from the roof of the house on to the bird, and this they will do if no other means of access is available.

When poultry-houses become infected with ticks there is, in our opinion, only one safe method left open, and that is to get rid of them. Should the house not be of any great value, the wisest course is to burn it and build a fresh one in another part of the yard; should it be too valuable to burn it must be thoroughly tarred both inside and out, care being taken that the tar gets into every crevice and joint. Paraffin will serve the same purpose as tar, but being more expensive, is not so likely to be used; carbolineum is also useful, and has the advantage that it soaks into the wood and acts as a preservative, but the cost of 3s. 6d. per gallon is rather high; where houses are built of match or floor-boarding it is almost impossible to get the tar into all the crevices, and we would advise in such cases that the house be turned into a sectional one, *i.e.*, one which can be taken to pieces in sections; a tank must then be obtained into which sufficient tar must be placed to cover the bottom to a depth of about 6 inches, then each section should be dipped, care being taken to see that it is completely submerged. This will effectually destroy all of the ticks as well as their eggs. This method, of course, entails a certain amount of expense, but where numbers of poultry are kept it pays. Where houses are built of iron the difficulty is not so great, as the iron can be taken off and passed slowly through a fire, and the woodwork can be easily treated.

A blast lamp, such as is used for removing old paint, is very effective, but can only be used when the house is made of iron or plain ungrooved wood, as the flame cannot penetrate with sufficient force into the grooving of match boarding or flooring.

Dips are of little use for destroying adult ticks, we experimented with some of these in 10, 20 and 30 per cent. solutions, and finally dipped them in crude dip, but they crawled out, and in 24 hours were as lively as possible. It is quite possible, in fact highly probably, that fowl ticks are capable of carrying infection of disease, and though we have not had any opportunity of testing this, we have strong reasons for believing that it is so.

Because a poultry-keeper does not allow his birds to roost in fowl-houses, but prefers to let them roost in trees, he must not imagine that

his birds are immune from the attacks of this pest, for they thrive under loose bark of trees or under the rough ends of broken boughs and are, as a rule, more difficult to get rid of than when confined to poultry houses.

On visiting a certain farm recently, one fowl run was pointed out to us, the farmer stating that he could not keep birds in it ; he thought that the ground was fouled, but on inspecting the house we soon discovered the trouble, for it was infested with ticks.

In another instance, a gentleman had recently moved into a fresh house, and a friend had given him a few fowls to start with ; he had not had them for 24 hours before the majority were sick and two were dead, the owner was inclined to think that his friend had supplied him with birds that were sick, but on visiting the yard at his request we discovered that his birds were suffering from the effects of ticks which were swarming in the fowl-house and on the surrounding trees ; the house had not been occupied for 18 months yet the ticks had survived for that period without, it is reasonable to suppose, any food, which illustrates their tenacity of life.

In appearance the fowl tick is of a brownish colour, and varies in size according to its age from that of a pin head to the size of one's little finger nail. When quite young, before having had their first feed, they are of a whitish colour with long legs like a spider, but the body is very small, as they get older the body increases in size, but the legs seem to get shorter and more powerful.

If their presence is suspected in a fowl-house it is a good plan to insert the blade of a pocket knife into any cracks or crevices and if, when withdrawn, the blade bears blood marks it generally means that ticks are present, and steps should immediately be taken to get rid of them.

EXTRACTS FROM EXCHANGES.

RECENT PROBLEMS IN AGRICULTURE.

(Circular No. 15, University of California.)

What a University Farm is for.

INTRODUCTORY NOTE.—*Liberty Hyde Bailey, Professor of Agriculture in Cornell University delivered a lecture for the University of California Summer Session on Friday evening' August 4th, 1905 on "Present Problems in Agriculture" That portion of the lecture which dealt with the question of the purposes of a University Farm is here printed as a contribution to a question of pressing public interest*

The agricultural college idea is by no means new; it is at least two hundred years old. In this country the agricultural college, as an established fact, originated about fifty years ago. Year after next will be celebrated the fiftieth anniversary of the Agricultural College, near Lansing, Michigan. The first agricultural colleges were established as a protest against the older kind of education that did not put men into touch with real affairs. The Land Grant Act of 1862 marks one of the greatest epochs in the history of education; it is the Magna Charta of education. Its purpose was to give instruction in those subjects and affairs which have to do with real life. And, what are they? They are largely agricultural and the mechanical arts. As these agricultural colleges were largely a protest against the older education it was perfectly natural that at first they should be separate institutions.

About one-half of the agricultural colleges of the Union are separate from the universities proper. They are doing good work, and I am saying nothing whatever derogatory to them There are some reasons still given for having separate agricultural colleges. It is said that other courses will attract the young men from the farm. Now, if the agricultural college can't hold the young men it ought to lose them; the time is past when we shall put blinders on the young men. Again, it is said that the farm boy will be looked down on, but students will not look down upon him if his work is of equally high grade as that pursued in other courses. Sometimes the agricultural college is wanted in a separate locality to satisfy local pride. A locality wants to have an agricultural college and offers inducements to get it. This does not consider the merits of the case. In some cases, a broom factory might be just as satisfying to the community. The University idea is coming to be a unifying idea in the community, and all university work should be kept together. The time is past when the agricultural college should be torn out of the university and be set off by itself.

The agricultural college is founded on the conception that education must relate itself to life. Important corollaries follow. In

the first place, agricultural education should not necessarily be bound by academic methods. The teaching work in a college really divides itself into two parts, (*a*) the true college work, leading to a Bachelor's degree; (*b*) postgraduate work, leading to two degrees, the first of these being the Master's degree, which should be given for experimental and investigational work, the work involved in the collection and accumulation of facts, etc., and the Doctor's degree, which should be given for a philosophical consideration of the facts and the collection of data.

Two great enterprises have now come into the college—the experiment station and university extension. They are not university work in the old academic sense. The extension enterprises form the best illustrations of the leadership the university has now acquired in public affairs. The university is required to do university extension work and it goes beyond the old academic ideals.

Agricultural education also rests upon a large and quickened idea of the laboratory method. We are introducing laboratory methods into every school in the country; the kindergarten, manual training, the school garden, and science work—all mean the laboratory method. And now we also introduce the affairs of every-day life into the schools. All laboratories are pedagogically valuable in proportion as they are in vital connection with theoretical instruction. No school, whether in California or elsewhere, from the primary school to the university is a good school unless it has laboratory work. The effort is now being made to introduce into every high school in New York a year's work in biology for the first year.

All this brings up the whole question of the university farm. The college or university farm developed with the Land Grant Act. In its history it has gone through several phases. It was first conceived of largely as a model farm, and, of course, the model farms became the laughing stock of the farmers of the state; and they will always be. If they are model farms they have little pedagogical use. One farm cannot be a pattern farm for all conditions. There are thousands of model farms. Model farms are good farmers' farms. The State cannot afford to go into the model farm business in connection with university work.

In the second place, the farms came to be used merely to illustrate farm practices. In the old days we had museums in our colleges, and persons could go and exclaim as they saw the wonders. We still need museums, but we also have collections with which to work. It is not enough that students merely see things growing or see different breeds of animals. They must come nearer than merely to look: they must use and handle.

Again, college farms were sometimes run with the idea of making a profit; but you cannot run a farm with profit with student labour. If the State is to make money out of a farm, then it must not be used for teaching purposes, but must be conceived of as an out and out business enterprise.

In the next place, there was an idea that these farms ought to represent the commonwealth—that a farm should be "typical" of the State. It is a mighty poor State that can be typified in one farm. If the State wants a typical farm let it have it, but do not burden the University with it. Put it in charge of a Chamber of Commerce, or other advertising organization. Anybody can farm typical land.

Then there was a long period of years when the college farm was used very little or even not at all. Not knowing just what to do with them, many of them have been allowed to drift.

Then there came the passage of the Hatch Act in 1887, which established the experiment stations; and this afforded a means of utilizing the college farm. There are a good many of our institutions which are now carrying farm lands as experiment stations. Of course we should have farms for research. There are two kinds of research work on farms. One kind of research is in farm practice; the other is research in the fundamental physical, chemical, and physiological problems, which must be done on some farm directly under control.

Now we have come to the final and proper stage—the farm must then be a laboratory. Thus primarily it must be a laboratory enterprise, and the pattern and model idea are only incidental and secondary. If your people do not believe in this idea, then you must educate your people. A college farm is not primarily for the purpose of growing model or perfect crops. I should rather have the opportunity to teach one student by means of a farm than to show one hundred persons a field of perfect pumpkins.

If we study ploughing in the class room, we must also study it in the field, even if we destroy a crop. We must determine and test the relation of ploughing to moisture, aeration, microbic life, and many other questions. It is more important that a man learn how and why to plough than it is for the college farm to grow a crop of wheat. Even if I tore up the drainage on a farm in order to teach it, I want to be able to do it. The botanist pulls up the plant to study it. In learning how to grow potatoes one should pull them up and study the root system. Not long ago I was asked how deep potatoes should be planted in a certain soil? I asked, "How many of you know whether the tubers form above or below the feeding roots?" Four or five guessed, but no one knew. But on that fact depends much of the success in planting potatoes. If your students want to see a model orchard, they have a thousand of them in California. We want such an establishment as will allow us to drive our cattle right into the class room. We are this day building a class room at Cornell which will hold stock, and which has seats for the students on the sides. They will study real live cattle, not pictures and models. The young men study those cows and find out why they are good and bad cows. They examine their conformation, etc. These cows are just as much laboratory material as the plants of the botanist or the chemicals of the chemist. Next week, if we should be studying the question of beef cattle, they are brought into the building

and the students study them just the same way your students study the stratification of rocks. Ten acres of land to use when I want it, and as I want it, is worth more pedagogically than a thousand acres to look at.

The value of a university farm from a university man's point of view consists in its usefulness as a means of teaching. If you do not want to call it a farm, call it land. The better it is as a farm, the better it ought also to be as a laboratory; but the laboratory utilisation of it should always come first. If you are not using farms as a means of training men you are not using them for university purposes. A director of an agricultural college said some years ago when a visitor complained that he didn't consider the college farm to be a model farm, "I would rather have a good man with a flower pot in a window than have a poor man with a thousand acres of land." A university farm justified from the university or pedagogical point of view must be made a true laboratory to collate and articulate with the theoretical instruction, otherwise the future will not justify your possession of it.

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CHICAGO LIVE STOCK SHOW.

("*The Field*," *December 22nd*, 1906.)

The International Stock Show of Chicago, which takes place every year in the month of November, may be alluded to without fear of contradiction as the greatest live stock show in the world. Other exhibitions may claim a greater degree of excellence in certain departments and along special lines, but no live stock show in the world submits such a lofty standard in sheep, cattle, hogs, and horses, or serves such an important and extensive radius of stock-raising industry as this one does. Smithfield may be able to show primer beef cattle, Dublin and New York may fill the ring with a better class of light horses, but no city, taking into consideration quantity as well as quality of exhibits, can approach Chicago in general interest and excellence in all lines.

The unanimity with which "the International," as it is familiarly called, has been accepted as the representative American stock show is remarkable. Chicago's peculiarly central position on the fringes of the east and west of American farm and ranch interests soon made evident to all the continent's leaders in agriculture that this, and this only, was the ideal spot for a common ground of meeting for exhibition purposes. In addition, the meat-packing city, already on account of her vast insatiable market, the Mecca of the breeder, claimed a preference and consideration which no lesser rival could deny.

The rapid growth of the International Stock Show is on a par with the marvellous progress of the city itself. Seven years ago there was no "International," yet such is the power of money and

enthusiasm when in the hands of the right sort of organisers that, to-day, the Chicago stock show is the leading live stock carnival in existence. In the five or six years of its existence, it has grown steadily from the humblest beginnings. Gradually the buildings have been increased to cope with the increasing patronage, until the constant cry for more room resulted in the opening last November of a magnificent ring and amphitheatre with seating accommodation for many thousands of people, a building which it was thought would fill all requirements for several years to come. Yet, last year, during the brilliant evening parades, every inch of this space was taken up, the vast amphitheatre was packed from dome to doors, and hundreds of disappointed sightseers stood outside clamouring for admittance. Of course, the city itself supplies a large proportion of the visitors to the show, but many thousands of ranchmen and farmers are present from every State in the Union, and the general attitude towards the exhibits is one of expert criticism rather than of idle curiosity and interest. European and South American stockmen attend in large numbers, and British interest has always been kept alive by the fact that a British judge is asked over every year to officiate in the cattle class devoted to grades and cross-breds, and to place the ribbon on the grand champion fat steer of the show, and many notable Scottish and English breeders have acted in this capacity, holding their American trip in kindly remembrance for the splendour of the occasion and the lavish hospitality of their hosts.

Although the International began by being purely a fat stock show, its sphere of usefulness was not long in embracing the breeders as well as the feeders, and, on the convincing ground of its broad arena, representatives of the best herds in America meet to-day in a splendid rivalry. Although this is so, and although horses, sheep and swine divide the attention of the hundreds of thousands of visitors that pass through the showyard gates, yet, to the *bonâ fide* ranchman and farmer, the main attraction and object of the show is still to be found in the fat cattle.

One strong reason for the popularity of the International lies in the fact that, being the head and front of the cattle industry, it naturally supplies the last court of appeal on the question of individual merit. Its judges are the soundest trained experts that the continent can afford, and their given decision decides finally—in the public mind, if not always in that of the animal's owner—the order of merit of the champions of the State fairs and lesser shows. To carry a blue ribbon from the ring in Chicago is to bear away no insignificant honour, and a country champion that has not challenged his peers at the International is held of little amount in his district.

The great show extends over the six working days of the week, and from Monday morning to Saturday night the flags of the Live Stock Association flutter on gateway and dome, while a ceaseless stream of sightseers clicks the turnstiles from nine o'clock in the morning till six in the evening, a stream that is doubled and trebled again at seven o'clock, as the great amphitheatre is filled for the

evening parades. The influx of country people is tremendous. When one considers the marvellous railway facilities of a country like America, the people's disregard of distance when on pleasure or on business bent, and the immense provinces of which a city and a show like this form the centre, then one can obtain some faint idea of the crowds that descend upon Chicago at such a time.

From the nearer States of Illinois, Iowa, and Michigan the farmers come in their tens of thousands; from further Nebraska and Colorado, from the blue-grass pastures of Kentucky, and the rolling ranches of Texas, from New York City with its Wall Street wealth, and from the sleepy South with its social problems, from Canada and the far Pacific coast, they gather in their thousands. For months before the event, that catchword in the country is: "See you at the International," and everyone whose interest lies in live stock is pledged to be there. In any other city, except, possibly, London and New York, the crowds would be overwhelming, unmanageable. In Chicago they disembark at her huge railway stations and are swallowed up in her interminable streets. They certainly flood the stockyards quarter with an unusual activity, but, in the business part of the great city, one is scarcely aware of their presence.

The Chicago show has certain features which make it unique among exhibitions of the kind. One of these is the strenuous competition of the greater agricultural colleges, which, bringing their stock long distances from their individual States, here meet upon common ground and match their fat cattle and the champions of their various breeds against those of one another and of all agricultural America in a keen but friendly rivalry. The most coveted honour is, of course, the championship of the show, and this has already been won three times by steers fed by the colleges. The professors of these institutions encourage their advanced students to attend the International in the interests of their work, and there are no keener and more intelligent observers in the crowd around the ring than these eager, watchful young fellows, who criticise the judges fearlessly from their own already considerable practical knowledge. When the stock of any college takes leading place in its class, then her students, in manner purely American, stand up shoulder to shoulder, waving the colours of their Alma Mater, and give the particular "yell" of that particular college with the lusty strength of lungs grown healthy on farm or prairie or mountain side. Here and there may be seen groups of students following one of their professors along the line of stalled horses or cattle, while he points out to them a judge's reason for this or that award. The value of such practical instruction among such a high-class of live stock is of incalculable benefit to the agricultural youth of America, but even more than this is done for the student. Every year a substantial prize is given for the best stock judging done by a team of six students entered from an agricultural college. These boys are carefully prepared for the contest by their instructors, and their work is done upon the horses, cattle, and sheep entered for the show before the legitimate judges have handled them.

Great enthusiasm characterises these contests, and to win the trophy for the year is an honour highly sought.

Another noticeable feature of the Chicago show is the competition for car loads (*i.e.*, railway truck loads) of fat cattle. Entries for this event are railed from immense distances, and nothing at the exhibition attracts more attention from the genuine stock-breeders. But if you asked the average visitor to the International what was the most popular feature of the great show and the drawing card of that strenuous, crowded week, he would tell you without hesitation the six-horse teams. As everyone knows, Chicago is the home of the meat-packing industry. Half a dozen wealthy firms practically control the business. To these companies and the individuals who rule their destinies, rivalry is only whetted when carried out on the broad base of pecuniary possibility. The street teams of these large firms have long been noticeable for the beauty of the Clydesdale and Percheron geldings that composed them. It is safe to say that no showyard has ever afforded such a spectacle of unique wealth and splendour as is supplied in one of the evening entertainments at the International when the great building is packed from roof to floor, and one after another the half-dozen six-horse teams, yoked two abreast, come prancing into the ring with arching necks and foamy bits, with electric lights blazing on the harness, on the tall peaked collars, and shining backbands, swinging round the ring at an active trot, while the people stand up and cheer their favourites to the echo. It seems more like some scene in fairyland than a picture framed in the heart of a great, prosaic, commercial city. No one who has seen it will ever forget it—the sweep and glitter and glory of it. The cattle, the sheep, the swine, and most of the horses you might meet with anywhere, but those magnificent trampling teams of Packingtown are Chicago's own! —(Will H. Ogilvie.)

AGRICULTURAL EXPERIMENT WORK IN THE UNITED STATES.

(*Journal of the Board of Agriculture, October*, 1906.)

The work of agricultural investigation and research in the United States has made very great progress in recent years. There is, in the first place, the Department of Agriculture, which is devoting itself more and more to scientific work, and becoming, in fact, a central experiment station, and, secondly, there are the agricultural experiment stations established in 1887 in each of the States and territories. There are now sixty of these, of which fifty-five receive grants from the National Government. The act establishing the agricultural experiment stations made them practically independent of one another and of the Department of Agriculture, but the relations between these bodies have in reality been very close. To quote Dr. E. W.

Allen, the Assistant Director of the Office of Experiment Stations,* "they have been drawn together by a common purpose, and as their work has progressed they have often found themselves in positions of mutual helpfulness and dependence. They have developed together. Together they have demonstrated the utility of agricultural investigations, and shown its practical importance to the farmer and horticulturist. They have laid the foundation of a science of agriculture as a basis for teaching, and have won the confidence and appreciation of the general public to such an extent as to make their continued development possible."

The period covered by the experiment station movement has seen a great change in the Department of Agriculture, both in character and in material equipment. The Department has become in effect a great experiment station, with probably the largest personnel and the most liberal appropriations of any institution of its kind.

It is divided into a number of bureaux or offices dealing with different classes of agricultural matters, and grants are made to these bureaux, which include not only the salaries of the scientific and administrative staff, but also sums expressly allocated to various investigations, or, in some cases, lump sums for research into a number of allied questions, the distribution of the money being left to the discretion of the Secretary of Agriculture. Thus, the Bureau of Plant Industry investigates diseases of plants, undertakes the breeding and selection of new varieties of fruit, cereals, and cotton, and also receives separate grants for pomological and botanical investigations, enquiries into grass and forage plants, tea-culture, and the growth of sugar-beet. In the same way the Bureaux of Forestry, Chemistry, Entomology, Soils, etc., undertake experimental work on matters coming within their scope. In the past, the work has largely had the character of scientific research in the laboratory, as the Department has only recently acquired an experimental farm. Speaking generally, the Department is strong in laboratory facilities, and has the advantage of the assistance of men who are recognised experts in special subjects, but it possesses very little provision for carrying out experiments on a practical basis or under field conditions. The writer previously quoted points out that this is a wise provision, as the conditions at Washington would be representative of only a small fraction of the country. On the other hand, the local experiment stations are usually strong in their provision for practical work and for the testing of theories on a practical basis. Nearly all of them have farms at their disposal, with experimental fields, orchards, and live stock. They have the advantage of a close association with practical farming operations and intimate relations with the farmers. They have, therefore, the real problem of their districts brought home to them in a variety of ways.

The Department, however, possesses the advantage of material

* "Year Book of the Department of Agriculture," 1905.

resources to a far greater extent than the stations. The total income of the fifty-five stations is about £285,000, whereas the vote for the Department excluding the Weather Bureau) was £1,144,000 in 1906, and, although an important part of the latter sum is absorbed by administrative work, yet the balance available for research is very large compared with the resources of any individual station.

The natural outcome of this position should obviously be one of mutual help and independence, and, in recent years, there has been an increasing co-operation in experimental work between the Department and the separate stations. The importance of this has been recognised by Congress, which, in the Appropriation Act of the present year, places the aid of the Department at the disposal of the stations in a variety of ways. For instance, in making grants to the Department for conducting experiments in animal breeding and feeding, plant breeding, and selection, for testing new plants, for studying the influence of environment upon plants, market conditions affecting the fruit and vegetable trade, cereal production and for many other subjects, specific mention is made of the experiment stations as co-operating agencies. This union of facilities and resources may be said to recognise the fact that the Department usually has the advantage in point of funds, in possibly a broader survey of the general field, and it can often place a larger number of specialists and assistants in the fields, whereas the stations have the plant for carrying on the work as well as a superior knowledge of local conditions.

The dissemination of information as to the results obtained also affords an illustration of the way in which the Department and the stations supplement each other's efforts on behalf of the American farmer. As in the case in England, the effort to reach the farmer effectively is a most difficult task, but there are, in the United States, three different agencies, one of which is almost unknown in this country. There are (1) publications; (2) practical demonstrations; and (3) talks and addresses at meetings and farmers' institutes.

Publications.—The Department of Agriculture issued, in 1905, 476 different publications, apart from reprints, and, approximately, 12½ million of bulletins and reports were circulated. Nearly one half of these were farmers' bulletins prepared especially for popular consumption. The experiment stations, in the same year, issued 461 bulletins and reports, of which about 6½ million copies were distributed. The lists of persons who receive these publications regularly now contain 731,000 names. The issue of these bulletins is restricted by want of funds, but the summaries which appear in the Department's publications bring them to the notice of many persons who would not otherwise be reached.

Practical Demonstrations.—Practical trials and demonstrations are becoming a somewhat more prominent feature, and both the Department and the stations have undertaken work such as spraying potatoes and orchards, treatment of seed for smut, alkali reclamation,

irrigation, cold curing of cheese, etc., in localities where such matters seem specially applicable.

Farmers' Institutes.—This means of education has been described as the Adult Farmers' School. They are meetings at which lectures are given and subjects discussed, and are held sometimes for one day, once a month, and sometimes at longer intervals for two, and, occasionally, for four or six days. They date from early in the seventies, and are now an important factor in American agricultural life. They are held in nearly all the States, and, in 1903, the attendance was about 900,000. It will easily be understood that they afford a valuable means of instructing farmers in improved methods and practices, and of bringing the results of the work of the stations home to them. In twenty-nine States the management is entirely in the hands of the colleges and stations, and, in the others, the station officers take a prominent part. There is a great demand for these men as lecturers. The Department has not taken much action in this direction, but a considerable number of officials have been sent to meetings in response to special requests.

A novel form of instruction which has been adopted in Iowa since 1904 was the employment of a special train from which lectures were given by experts for the purpose of emphasising to farmers along the route the importance of seed selection in growing corn, wheat, and potatoes, and also for instruction in dairying. In 1905, this train covered 7,855 miles during fifty-seven days, stopping at about ten different places each day, two lectures being delivered at each place. The audiences are estimated as numbering over 127,000, or an average attendance of 110 at each lecture.

In other States, excursions have been run to bring farmers to the college and station in order that they might see for themselves what was being done, and have the aims and applications of the experiments pointed out to them. In North Dakota, for example, these annual excursions have been a feature for several years past. In the morning the party is conducted round the fields, stables, and dairy, and, in the afternoon, a meeting is held in the Assembly Hall where questions are answered and short addresses given on subjects of interest.

It is obviously impossible to estimate the effect of all the experimental work which has been carried out during the past twenty years, but there seem to be a number of instances in which its influence can be definitely traced. This is particularly the case in the introduction and distribution of new crops and new varieties, such as Kaffir corn, Durum wheats, numerous kinds of other cereal and forage crops and sugar-beet. A number of these introduced crops are regularly grown in many States, and a large number of the new varieties have now become more popular than the common sorts. The "Year Book of the Department of Agriculture" contains an interesting article by Mr. G. J. Schulte, of the Office of Experiment Stations, in which he endeavours to trace the influence of experiment station work on the culture of field crops. The extension of the cultivation of new varieties affords naturally the most striking and

obvious examples, but numerous changes in methods of cultivation which have taken place in the last fifteen or twenty years seem largely attributable to the teaching and practical work of the experiment stations.

* * * *

In "Science" of November 30th, 1906, a similar extract appears:—"The United States Department of Agriculture has grown from a staff of 108 persons, an annual income of somewhat over two hundred thousand dollars, in 1881, to a great executive department with a total appropriation for the present fiscal year of nearly ten million dollars. The land-grant colleges, too, from feeble and more or less destitute 'cow colleges,' have acquired an acknowledged and honoured position among the institutions for technical education, with a total endowment of over eighty one million dollars and an annual income of over eleven and three-fourths millions, with faculties aggregating two thousand six hundred and seventy-two, and giving instruction to a total of nearly sixty thousand students, of whom nearly nine thousand are students of agriculture. In place of a few scattered bulletins and reports, issued in small editions, the experiment stations and the Department of Agriculture have become great publishing agencies, and, instead of its being difficult to find a medium for the presentation of the results of investigation, the difficulty more often seems to be to find suitable material for the numerous publications called for by law or popular demand. Finally, the organic unity of these institutions as a class has been secured through the Association of American Agricultural Colleges and Experiment Stations. Surely this is a magnificent record for a little over a quarter of a century, and the end is not yet.

"With this stupendous change in the situation, it might almost seem as if there were no function remaining for a society like this. Are not all these public institutions agencies for scientific investigation in agriculture on a scale and with resources such as to make a private organisation superfluous? Is it still necessary to promote agricultural science?

"Twenty-five years ago the conception of an experiment station was that of a comparatively small institution exercising a police control over the manufacture and sale of certain agricultural products, notably fertilizers, and carrying on scientific research largely by laboratory methods. To a considerable degree this conception still obtains in foreign countries, but, in the United States, the stations have had an unexampled development. They are rapidly growing into great departments, touching the practice of agriculture in their several localities at all points, and the leaders in a vast propaganda for the elevation of rural life. We feel a just pride in this peculiarly American development of an adopted institution, and in the large measure of success which has attended it, but it would be foolish to shut our eyes to the accompanying dangers, and not the least of

these is the drying up of the sources of power and inspiration by the failure to duly promote science along with practice. Not only does the pressure for results tend to the subordination of the scientific to the practical, but the management of these great institutions is making heavier and heavier demands on the time and energy of some of our best men. In fact, we seem to be developing a new type of leader in agriculture comparable with the university president, who is primarily an administrator, and whose chief function is to set other people at work. All honour to the successful administrator. Through his administrative work he is often a most efficient promoter of science. But let us not forget also to see to it that our system provides due honour and reward for the successful scientist and investigator. While the American type of experiment station is an admirable institution, and while the popular work of the stations and colleges is of vast importance and benefit, we must not forget that it all rests on the truths of science, and that, unless science makes progress, the popular work will soon be marking time.

"The year 1906 has witnessed a notable forward step in the development of agricultural investigation. The passage of the *Adams Act* has doubled the United States appropriation to experiment stations, nominally, in five, and, practically, in four years. This fund differs from the *Hatch Fund* in that the act specifies that it is to be used only for 'conducting original research or experiments.' It is not too much to say that the great opportunity offered by the passage of the Adams Act, which has been the occasion of so much congratulation will, like every other opportunity, prove also to be a day of judgment for the stations, in that it will reveal to all men their conception of original research, and demonstrate whether or not they have a broad fundamental grasp of the idea of investigation. Differences of opinion regarding the application of this fund are already apparent. The stations stand at the parting of the ways. Will they simply add demonstration to demonstration, propaganda to propaganda, or will they grasp the opportunity to dedicate this new fund sacredly and irrevocably to original scientific research, broadly conceived and liberally executed?

"These, then, are some of the larger objects which, as it seems to me, a society for the promotion of agricultural science should set before itself:—

"1. To aid in maintaining among our investigators in agriculture the highest ideals of scientific research and to help to furnish the inspiration for the pursuit of these ideals.

"2. To seek to educate the public to a greater appreciation of the need of scientific investigation into the underlying principles of agriculture and to a realisation of the practical benefits flowing from it, and thus to promote the cause of agricultural science in the experiment stations and kindred institutions.

"3. To seek to impress upon university authorities and upon

wealthy donors, the claims of agricultural science to recognition as a most promising and attractive field for the endowment of research."

* * * *

In "Nature" of December 20, 1906, another interesting article on the same subject appears:—"In concluding a course of Cantor lectures at the Society of Arts on Monday, on the subject of 'Artificial Fertilisers,' Mr. A. D. Hall, Director of the Rothamsted Experiment Station, pointed out that only by continued investigation and experiment can a knowledge be obtained of the conditions necessary to make the maximum profit out of the land, crops, and stock. The teacher can only hand on what is already known, and much yet remains unknown about the growth of our commonest crops and the action of standard fertilisers. Adequate provision for scientific investigation of agricultural matters is of national importance, as the following remarks made by Mr. Hall show; but though a few counties and other local bodies are carrying out demonstrations, Rothamsted, with its comparatively small endowment, remains practically our only experiment station where problems in agricultural science are studied with the object of making new knowledge, and State aid for research amounts only to a few hundred pounds a year for the whole country.

"Looking at the average yields of the various countries of the world, we find that Great Britain is the most intensively farmed country; it obtains the biggest crops per acre, it has to spend the most to obtain them. Furthermore, the biggest crop the greater are the risks of disease and blight, the greater are the difficulties in securing high quality. Here, then, in Great Britain exists the greatest need for knowledge and investigation; we cannot even always beg knowledge from wiser countries, for many of our problems are special and brought about by the very conditions of high farming which prevail here. England was the first country to start an experimental station, yet Rothamsted still remains the only institution solely devoted to agricultural research in the British Isles if we except the farm of the Royal Agricultural Society at Woburn. The income of the Rothamsted station, derived solely from private benefaction, is about £2,600 a year; in the United States each of the fifty-three States possesses a station receiving £3,000 a year from the Federal Government, besides what the State itself may contribute, in addition to the great central department of agriculture to which reference has already been made."

RURAL NOTES.

Bethal.

December.—Good rains have fallen, especially at the beginning and the latter end of the month. Ploughing is practically finished throughout the sub-district. The crops are looking well, especially the mealie and potato crops. In some parts the yield of fruit is better than it has been for several seasons, though generally it has been badly affected by hail. Vegetables generally are doing well. On some farms locusts have done considerable damage. The current prices of mealies are from 12s. to 13s. ; forage, 5s. to 6s. per 100 lbs. ; and potatoes, 10s. a bag. Live stock are in good condition. Water and grass are plentiful—in the middle of the month the ground became rather hard, but the good rains at the end have put matters right again. Native labour supply is fair—rates of pay, £2 a month with food.

January.—Heavy soaking rains have fallen throughout the month —there has been little sunshine. Ploughing has been confined to the breaking up of new ground. Hoeing and cleaning among the crops has been carried on, but not as much as should be done owing to the great rainfall. Mealies are in excellent condition. Pumpkins are showing signs of rust due to too much rain. On the whole everything points to a successful season. On some low-lying lands there is every danger of the crops being injured by excess of rain. Mealies realise 12s. to 13s. 6d. per 200 lbs., and forage about 6s. per 100 lbs. The condition of stock is good, grass and water being very plentiful. Native labour supply is plentiful—rate of pay £1 10s. to £2 10s. per month with food. Mr. Rowan, the wool expert, held a very successful demonstration in wool growing, handling and sorting. There was a large attendance—about 200 to 250 persons being present. There have been some high-class rams for sale during the month in the district ; several have been sold, and there seems to be every desire on the part of the farmers to improve the wool of their flocks.

Boksburg.

December.—Rainfall for month registered 2.27 inches. The weather was warm and brilliant ; first part of month rather dry. The rains have improved all crops tremendously, and mealies and potatoes are looking especially well. There will be some heavy crops of potatoes this season in the district, as many farmers have gone in largely this year for potato sowing. Fruit is now fairly plentiful, but still of inferior quality. The following are some market prices :—Eggs, 1s. to 2s. 3d. per dozen ; turkeys, 12s. 6d. to 15s. each ; fowls, 2s. 3d. to 2s. 9d. ; mealies, 11s. to 13s. ; potatoes, 8s. 6d. to 13s. 6d. ; pumpkins and melons are now coming forward at reasonable prices. The veld is

in grand condition, and all stock are looking well. Water is plentiful. There is no change in native labour since last report.

January.—Rainfall for month, 9.02 inches. Wind N.N.W., with thunderstorms; cool and cloudy. The rainfall for the month has been well above the average—almost abnormal. Farmers are complaining that the potato crop is in danger of being spoilt by too much rain. Mealies will show heavy returns. Fruit and vegetables are plentiful. The heavy rains do not seem to have affected peaches and apples. Market prices :—Mealies, 8s. 6d. to 10s. per bag; green mealies, 1s. per dozen; potatoes, 6s. to 8s. 6d., medium to good; poultry, fairly plentiful; eggs, 1s. to 1s. 6d. per dozen; peaches, plums and apples are fairly plentiful, with good local demand. All stock are in good condition. The veld has never looked better, and water is plentiful with all the fountains running. The native labour supply is steady.

CAROLINA.

December.—The heavy rain of previous months continued during December, and not altogether to the benefit of the farmers. In some cases the ground has become waterlogged, and this, with absence of sunny weather, has retarded the mealie crop. Some farmers complain that portions of their lands have been washed bare by flood water, and in a great many cases there has been difficulty in reaping mature crops of forage and in tilling young crops. The rivers have been frequently in flood. Misled by the dryness of late years some farmers have ploughed and planted in vleis, but this year the vleis are full of water and the loss of time, labour and seed will discourage further experiments. Stock of every kind are looking well, and what sickness there is among the sheep is said to be due to their fattening too quickly. White and native labour appear to have been plentiful during the month. Forage is selling at 6s. or 7s. per 100 lbs., or 25s. to 30s. per 100 bundles; mealies can only be obtained at prices higher than those ruling at Pretoria and Johannesburg. Potatoes are cheap at 10s. to 15s. a sack; fruit is plentiful but inferior, owing to the constant wet weather. Apricots, 1s. per 100; apples, 4s. to 5s. per 100.

January.—Rain was persistent during the month, and the evils reported last month, *i.e.*, the water-logging of ground and the washing away of low-lying crops, continued. On the whole, however, the rain has been very beneficial. The mealie crop this year should be a good one, and forage will be plentiful and of good quality where free from "rust." Fruit and vegetables are plentiful, but the former is somewhat spoilt and tasteless owing to the constant wet weather. Forage crops will be ready for reaping towards the end of February. All farm stock are in good condition, though the weather has not been very favourable for sheep. There will be no want of water during the winter. Farmers anticipate an early and severe winter. The asbestos mines are unable to obtain local labour to enlist for long periods, but farmers have plenty of squatters, and boys for town work are easily obtained. Farm crops,

fruit and vegetables are obtainable at the same prices as ruled last month.

Ermelo.

December.—Rainfall during the month was about 4½ inches. A fair amount of warm weather was experienced which promoted the growth of the crops considerably. The rain was in almost every instance accompanied by severe thunderstorms. All ploughing has now been completed, and the mealie crops in the western portion of the district promise very well indeed. Owing to almost continuous wet and cold weather during the months of October and November the crops made very little progress, but have come on well during December. Oat hay is now being reaped, and potatoes are being taken out. Vegetables are at present plentiful, and a fair fruit crop is anticipated. Some very fine samples of lucerne were sold from Mr. Ewald Esselen's farm Onverwacht, demonstrating that lucerne growing is not impossible in this district. Potatoes and oat hay have yielded very good crops, the local prices being 7s. 6d. per bag of 150 lbs. for potatoes, and about 4s. per 100 lbs. of oat hay. Live stock are in excellent condition all round. The veld is at its best, and water is in abundance. During the month Mr. Rowan, the wool expert, paid a visit here and gave a lecture and practical demonstration of shearing, sorting and packing of wool. The lecture was well attended, and all the farmers were very well pleased with Mr. Rowan's efforts, and gave an expression of opinion that the farming community had to thank the Department of Agriculture for bringing new facts before them in such a practical form. Labour supply has been plentiful. The Railways, Public Works Department have their full complements working, and labour is being engaged for the Waterval Boven deviation, mines and other works.

January.—The month was remarkable for an almost continual rainfall. A few very hot days were experienced. The rainfall at Ermelo amounted to more than 7½ inches, and was greater towards the eastern portion of the district. This has been the heaviest monthly rainfall up to the present during the season. Most of the oat hay was harvested during this month, the crop having a particularly good season. Owing, however, to the continuous rain a good proportion of the crop will be spoilt. The yield of potatoes has been likewise especially good. Vegetables are in abundance, and a lot of new ground has been ploughed up for the ensuing year. Owing to the rains the staple crop, mealies, has been considerably injured, as most of the low lying lands have become inundated and the crops drowned. The current price of oat hay is 20s. per 100 bundles, equal to 500 lbs. ; and potatoes, 5s. to 7s. 6d. per bag, equal to 150 lbs. All live stock are in excellent condition, and a mild winter is anticipated with late grass during the winter and early grass during the spring. The veld looks splendid, and hay cutting is proceeding in a much greater degree than any season before. The labour supply is plentiful, average wages being from 30s. to 40s. per month.

Heidelberg.

December.—The weather was warm, and very little rain fell during the beginning of the month, but during the latter part very nice rains fell. Considerable ploughing has been done both in cultivated fields and in breaking up new ground. Sowing of mealies, etc., was continued during the beginning of the month, as also planting of potatoes. Some oats have been harvested, which turned out better than was expected, through the good rains that fell during the previous few months. The crops look very promising. The potato crop has been very good, hence the price is low; only the best quality fetches 10s. per bag. Few mealies are offered for sale, and realise about 13s. 6d. per bag, and oats 5s. for 100 lbs. Stock are in very good condition. The veld looks exceedingly well, but on account of the rains not having been enough to make the fountains flow or fill the dams, water may become scarce in winter. Native labour still appears to be scarce, and those seeking work ask high wages.

January.—Splendid rains fell nearly all over the district; and the weather in general has been favourable for grain and stock. Much ploughing has been done in regard to breaking up of new lands for the next season. Practically no crops have been reaped through this month. Fruit and vegetables are plentiful. The following are more or less the prices :—Mealies, 10s. 6d. per bag; forage, 18s. per 100 bundles; potatoes, 6s. to 8s. per bag. The condition of the live stock is very good, and the veld is looking exceedingly well. Much water has been gathered in dams for the winter. White labour is in excess of demand. Native labour is still scarce.

Klerksdorp.

December.—During the early part of the month a great deal of wind was experienced, and towards the latter end a considerable amount of rain fell, registering in all 4.18 inches. Farmers are busy ploughing and sowing mealies and Kaffir corn, which are progressing favourably, excepting where destroyed by locusts. The following are the current market prices of some crops :—Forage, 9s. to 15s. per 100 bundles; mealies, 11s. to 13s. 9d. per bag; onions, 3s. 6d. to 7s. 6d. per 123 lbs.; potatoes, 5s. to 8s. per 160 lbs.; firewood, 25s. to 30s. per load; fowls, 1s. 6d. to 2s. 6d. each; tobacco, 4d. to 1s. per lb. Live stock are in good condition. The veld was bad during the early part of the month, due to locusts and want of rain. The diamond drill operating at the Klerksdorp Prison obtained a good supply of water at a depth of 100 feet. The Jumper drill, working for the Municipality at Klerksdorp, struck a splendid supply of water which, after testing, appears inexhaustible. A further hole is now being bored close to the last to secure a permanent supply to meet the demands of the whole of the town. Native labour is scarce—rates normal.

January.—Over 7 inches of rain fell during the month in Klerksdorp. In some parts of the district the rainfall was much less,

in other parts more. The mealie crops are progressing favourably. Fruit and vegetables are becoming more plentiful. The fruit, though not so plentiful as last year, is very satisfactory. The following are some market prices :—Butter, 6d. to 1s. per lb. ; ducks, 1s. 6d. to 2s. 9d. each ; eggs, 1s. 3d. to 1s. 7d. per dozen ; firewood, 25s. to 45s. per load ; forage, 7s. 6d. to 15s. per 100 bundles ; poultry, 1s. 6d. to 2s. 6d. each ; Kaffir corn, 9s. 6d. to 12s. ; mealies, 12s. to 13s. ; potatoes, 5s. to 10s. 6d. ; tobacco, 3d. to 1s. per lb. ; wheat, 18s. to 23s. 6d. Live stock are in good condition. Labour supply and wages are normal.

Lichtenburg.

December.—The rainfall registered 2.86 on 11 days. The rainfall has been of a steady soaking nature, without violent showers. Ploughing and sowing of maize and Kaffir corn have been going on steadily throughout the month. Wheat and oat crops are all harvested now, the yield being a very good one. The current market prices are :—Mealies, 11s. to 12s. 6d. per bag ; Kaffir corn, 9s. to 12s. 6d. per bag ; potatoes, 10s. to 15s. per bag ; wheat, 20s. per bag ; vegetables are getting more plentiful and cheaper. The weather has been very favourable for ploughing operations, and the area under maize and Kaffir corn is larger this year than usual. The locust officer has been doing good work in the destruction of voetgangers and large numbers of swarms have been killed. Flying locusts have now appeared in large numbers, and a considerable amount of damage has been done by them to growing crops. Stocks of all kinds are in excellent condition. Native labour is very scarce.

January.—Rainfall, 6.86 inches on 17 days. Very little ploughing was done after the 1st January. The very favourable early rains enabled farmers to get an unusually large quantity of maize and Kaffir corn in. Considerable damage was done to young crops by locusts, but in most cases the steady rains have brought the young shoots that were cut off on again. The current market prices are :—Mealies, 10s. to 11s. per bag ; Kaffir corn, 7s. 6d. to 8s. per bag ; potatoes, 6s. to 13s. 6d. per bag ; wheat, £1 per bag ; oat hay, £1 per 100 bundles, 4s. to 5s. per 100 lbs. Vegetables and fruit are plentiful and cheap. The crops are unusually forward this season. In some cases the maize cut off by locusts may be a little later, but the average yield this year should be a heavy one. Stock are in first-class condition. Grass and water are in abundance. Native labour is very scarce.

Marico.

December.—Rainfall, 3.25 inches, of 10 days. Total since 21st September, 1906, 14.36 inches on 33 days, *i.e.*, advance of last season 7.37 inches. Mean maximum temperature, 85.3° F. ; mean minimum, 59.8° F. ; mean temperature, 72.6° F. ; mean force of wind, 130.2 miles per day ; mean relative humidity, 59.3%. On account of the great damage done by locusts to the mealie crops throughout this

district, farmers are sowing their lands over again. Fruit trees—both citrus and deciduous—are doing well. From all quarters complaints have come in as to the bad condition of lucerne, which is infested by a certain species of caterpillar, devouring almost everything. Spraying with Paris Green (16 ozs. to 200 gallons water) has been recommended, but as yet no intimation has been received as to its effect. The market continues to be very well supplied. Potatoes are more plentiful, and are fetching from 5s. 6d. to 9s. a bag ; forage, 15s. to 22s. 6d. per 100 bundles, average 3½ lbs. each ; mealies, 12s. ; wheat, 25s. Owing to the splendid rains the live stock and veld have wonderfully improved. White labour is very plentiful, especially unskilled, while native labour is scarce.

January.—Rainfall, 5.34 inches, of 13 days. Total since 21st September, 1906, 19.70 inches of 46 days, *i.e.*, in advance of previous season 9.51 inches. Mean maximum temperature, 84.4° F. ; mean minimum, 62.4° F. ; mean temperature, 73.4° F. ; mean force of wind, 87.4 miles per day ; mean relative humidity, 73.2%. Farmers have finished ploughing in mealies. Owing to the seasonable rainfalls during the month, the early mealies look exceedingly well. Fruit trees—both citrus and deciduous—are doing very well. The current market prices are :—Wheat, 20s. to 25s. ; mealies, 10s. to 12s. ; forage, 17s 6d. to 22s. 6d. per 100 bundles ; peaches, 9d. to 1s. per 100 ; firewood, 5s. to 10s. per buckwagon load. Veld, as well as cattle, are in splendid condition. The water supply leaves nothing to be desired. White labour is greatly in excess of demand, while native labour is scarce.

POTCHEFSTROOM.

December.—Copious rains have fallen throughout the district during the month, and some parts have been visited by hail, doing damage to crops. Agriculture is progressing favourably as far as growing crops are concerned, but in many parts great damage has been done by locusts. Potatoes have been sown freely. Wheat and oat forage have been reaped, and the farmers have found a local market in the military. Fruit is doing well and vegetables are plentiful. The current prices of yellow mealies per bag are 13s. 6d. to 14s. ; Boer meal, 15s. to 27s. per bag ; potatoes, 12s. to 17s. per bag ; forage, 15s. to 25s. per 100 bundles. A great deal more dry lands are being ploughed and sowed with mealies, and more powerful ploughs are being used. Live stock are looking well. Water is plentiful and the grass good, except where it has been eaten off by locusts. Native labour supply is insufficient.

January.—Copious rains have fallen throughout the district during the month. Rainfall at Potchefstroom registered 5.83. Farmers are busy ploughing and sowing. Fruit and vegetables are plentiful and good. The current market prices are :—Forage, per 100 bundles. 15s. 6d. to 22s. 6d. ; butter, 1s. 3d. to 1s. 6d. per lb. ; Kaffir corn, 10s. 3d. to 11s. ; mealies, 12s. 6d. to 13s. per bag ; Boer meal, 25s. to 28s. per bag ; potatoes, 3s. 6d. to 6s. 6d. Boring for water continues with

satisfactory results, especially in the Klerksdorp sub-district. Stock are in good condition. Water is plentiful everywhere, and the veld is good. It is hoped that the abundance of rain will cause many dry springs to run again. Native labour remains the same.

Standerton.

December.—The weather has been very favourable for farming purposes. Taking the district as a whole, good and beneficial rains have fallen. Hail storms have been conspicuous by their absence. Bright sunshine during the day. The crops are in splendid condition, and the farmers are looking forward to the best harvest since peace. During the month a number of farmers put in good crops of winter potatoes. New ground is being broken up pretty freely owing to the helpful rains. The prospects are indeed very favourable. Good mealies are fetching from 12s. to 15s. a sack ; and early potatoes from 8s. 6d. to 10s. a sack. The condition of the live stock is first rate, the veld is in splendid condition, and water is plentiful. The labour supply remains unchanged. Mr. Rowan, the Government wool expert, gave a very useful demonstration in wool sorting and classing to a number of farmers in the Court House. Unfortunately the lecture was not as well attended as it would have been owing to the state of the weather. However, the farmers who attended greatly enjoyed the demonstration and profited by the lessons taught ; as a consequence the Resident Magistrate was asked to arrange for two demonstrations at Platrand and Val in this district, and Mr. Rowan has promised to appear at Platrand on the 21st instant, and Val on the 17th instant, and the farmers are eagerly looking forward to his visit. Practical demonstrations given by such an efficient man as Mr. Rowan do more good than years of legislation, and are much appreciated by the community. Arrangements are being rapidly pushed forward for the holding of the second annual agricultural show, which it is hoped to hold about the last week in March.

January.—Heavy rains have fallen throughout the district ; no hailstorms, and moderate amount of sunshine. A little ploughing—breaking up of new lands—has been carried on in various parts of the district. A few farmers are still busy sowing lucerne and planting trees, and the crops in general are looking remarkably well. It is hoped that so much moisture will not rust the crops. Blight is reported in several potato crops. Fruit and vegetables are plentiful and cheap. The following are some current prices :—Mealies, 9s. to 13s. 6d. per sack ; good potatoes, 5s. to 8s. per bag ; oat hay, 7s. to 9s. per 100 lbs. The live stock are in excellent condition, and the prospects for winter keep are very promising. There is any amount of water owing to the wet season. The Val Farmers' Association held their first stock sale on the 17th instant, and a very successful sale it was, considering the bad state of the weather, heavy rain falling the greater part of the day. It is reported that the stock sold realised over £800. Mr. Rowan, the wool classing expert, gave another successful demonstration, this time

at Val, which was much appreciated by those present. The Standerton Farmers' Association are making good progress towards the holding of their annual show, to be held on the 27th of March. The labour supply remains unchanged.

Tautesberg.

December.—The days have been cloudy and showery ; very few excessively hot days owing to rain. Rainfall at this place registered 7.45 inches. As regards ploughing operations, nothing is going on beyond breaking up virgin soil here and there, and turning over stubble lands. Tobacco, vegetables, etc., are being planted ; whilst the harvesting of wheat, forage, etc., has now been concluded. Young crops are looking well, especially mealies. The fruit crop promises a good yield, if in the interim no hailstorms visit the neighbourhood. The current prices of crops are as follows :—Wheat, about 25s. per sack ; forage. from 4s. 6d. to 7s. 6d. per 100 lbs. ; mealies, 14s. per bag ; potatoes, 20s. per bag ; Kaffir corn, £1 per 200 lbs. All varieties of stock are in excellent condition, also veld. Water is plentiful for all purposes. Fair amount of white labour is obtainable at from 5s. per diem with food ; while native labour is fairly plentiful at from 30s. to 40s.

January.—Rain has fallen during this month without intermission ; N.-E. winds prevailed ; and the rainfall here registered 13.95 inches. Agricultural operations are more or less at a standstill, the ground being so soaked that no ploughing can be carried on. Crops growing on well-drained areas are in first-rate condition, but those sown in low-lying lands are turning yellow and potatoes are rotting, such lands being waterlogged. A number of native mealie lands in the north, along the banks of the Oliphant's River, has been washed away by the overflowing of the river. Fruit is promising. Grapes are showing the bad effects of too much rain. Vegetables are scarce and high in price. Mealies are scarce and realise 15s. per bag, and in the north of the district 20s. ; oat hay, 6s. per 100 lbs. Live stock are in excellent condition. Native labour is scarce—rates of pay, 30s. to 40s. per month.

Volksrust.

December.—The month has been very wet, the rainfall on 14 days being 5.58 inches. Maximum temperature, 82.6 on 21st ; minimum temperature, 42.0, on the 6th. Many spruits have been overflooded and impassable. Some damage has been caused in the vicinity of spruits. Much too cold for the season. Building operations are at a standstill. Farming operations have somewhat been interfered with by the rain, the ground being very wet and sodden. Crops are very backward owing to lack of sunshine and heat. Everything looks healthy and the forage is almost ready for cutting in some parts of the district. Potatoes and other vegetables are doing well. Mealie crops are very backward. Fruit trees are heavy laden, and fruit should be

very plentiful this year. The present season's crops are not yet to hand. The prices of last season's crops are :—Mealies, 6s. to 7s. per 100 lbs. ; forage, 6s. 6d. to 7s. 6d. per 100 lbs. ; potatoes, 10s. to 12s. per bag. Live stock are in excellent condition. Feed and water are in abundance. Work generally is slack.

January.—Very wet weather has been experienced during the month. Rain fell on 18 days ; 12.38 inches were registered for the month. The total rainfall for the season to 31st January has been 30.69 inches. The maximum temperature on the 4th was 81.3, the minimum temperature, on the 22nd, was 46.3. Building operations are at a standstill. The excessive rainfall is causing much anxiety amongst the farmers, and it is feared that the potato crop will be spoiled. The mealies too are in need of more sunshine to bring them on, and unless the weather becomes warmer they will not ripen before the frost sets in. Other crops appear to be in good condition. This year's crops are not yet to hand, except early potatoes. Market prices :—Potatoes, 5s. 6d. to 7s. 6d. per bag ; mealies, 15s. to 18s. per sack ; oat forage, 6s. per 100 lbs. Vegetables are plentiful. Crops should, if the weather now clears up, come well up to the average of previous years. There have been two importations of merino stud rams, and the majority were sold for service in the district. The prices ranged up to £50 a piece. Stock generally are in very good condition. Grazing and water are abundant. Work is very scarce, the supply being greater than the demand, both white and native.

USEFUL FACTS AND FIGURES FOR FARMERS.

MILKING AND BACTERIA.

The Cornell Station has sent out for its reading course a bulletin on the subject of "Dust as related to Food," in which the importance of small openings for milk pails is taken up.

It has been shown on experimental test that great quantities of bacteria fall into the milk during the milking when the ordinary wide open pail is used, even although the udder is carefully cleaned beforehand. The easiest way to reduce these is to use pails with small openings. It was found that milk drawn in an ordinary pail contained 1,300 bacteria per cubic centimetre, while that drawn in a pail with half as wide an opening contained only 320 bacteria. The new type of covered pail should be universally used by dairymen.

A fly or a bit of hay or straw or a piece of sawdust or a small hair may carry enormous numbers of bacteria into milk, as is shown by the following experiments :

A living fly was introduced into 500 cubic centimetre of sterile milk. The milk was shaken one minute, and it then contained 42 bacteria per c.c. After 24 hours at room temperature, it contained 765,000 bacteria per c.c., and after 36 hours 5,675,000.

A piece of hay about 2 inches long was placed in 500 c.c. of sterile milk. The milk was shaken one minute, and it then contained 3,025 bacteria per c.c. After 24 hours at room temperature, it contained 3,412,000 bacteria per c.c.

One piece of sawdust from the stable floor was put into 500 c.c. of sterile milk. The milk was shaken one minute, and its bacterial content was then found to be 4,080 per c.c. After 24 hours at room temperature it was 7,000,000 per c.c.

A hair from a cow's flank was put into 500 c.c. of sterile milk. After shaking the milk for one minute it contained 52 bacteria per c.c. After 24 hours at room temperature it contained 55,000 per c.c., and after 36 hours over 5,000,000 bacteria per c.c.

* * * *

HOW TO EXTRICATE A MIRED ANIMAL.

(*Farm Conveniences.*)

An animal mired in a swamp gets into a worse predicament the longer it struggles. The effort to extricate it should be made in an effective manner, so that the animal may not be encouraged to exhaust itself in repeated exertions, which are useless, and only sink it deeper in the mire. The usual method is to fasten a rope around the animal's horns or neck, and while this is pulled by some of the assistants, others place rails beneath the body of the animal for the purpose of lifting it

out of the hole. This plan is sometimes effective, but it often is not, and at best it is a slow, clumsy, and laborious method. The materials needed for the method here referred to are all that are required for a much better one. This is very simple and two men can operate it, and, at a pinch, even one man alone may succeed with it. A strong stake or an iron bar is driven into the solid ground at a distance of 25 feet or more from the mired animal. Two short rails, about nine feet long, are tied together near the ends, so that they can be spread apart in the form of a pair of shears for hoisting. A long rope is fastened around the horns or neck of the animal, with such a knot that the loop cannot be drawn tight enough to do any injury. The rope is cast over the ends of the rails as they are set upon the edge of the solid ground, and carried to the stake or crow-bar beyond. The end of the rope is fastened to a stout hand-spike, leaving about a foot of the end of it free. This end is laid against the bar or stake, and the other end is moved around it so that the rope is wound upon it, drawing it up and with it drawing the animal out of the mire. The rope, being held up by the tied rails, tends to lift the animal and makes its extraction very easy.

* * * *

HOW TO PROTECT ANIMALS FROM FLIES.

In response to numerous inquiries for a cheap and effective substance to keep flies off of horses and cows, the veterinarian and the chemist of the Nebraska Station have prepared and tested a compound that gives excellent results. The following is the formula :—

Neutral Oil	4 pints.
Oil of Wood Tar	1 pint.

Mix and shake well. Apply to the animal lightly with a flexible brush or with a spray pump. Avoid excessive application, as a very light application is sufficient to protect the animal for some time as, for instance, during a milking period or longer.

In the above compound the odour of the tar keeps away the flies. The "neutral" oil is a petroleum product used to dilute the heavy, sticky tar oil. It does not form a gum like heavier oils, and does not blister like kerosene and benzine. Fish oil may be added to the mixture, but this is inclined to form a heavy gum on the animal's coat.

Any substance that will stick to the coat must of necessity be more or less gummy in its nature ; hence, it would be well to give the animal an occasional sponging with soap and water to remove the gum that has lost its odour. The hair of the tail especially should be cleaned every few days. If the hair has become very sticky, it may be cleaned by rubbing with a cloth moistened with the neutral oil. After this treatment, it should be washed with a little soap and water.

Any oil applied to the skin may produce slight blisters, especially if the animal is thin-skinned or out of condition, and the weather excessively hot, hence all such preparations should be applied very lightly and the application discontinued if blisters appear. It is almost

needless to add that any oily substance containing a gum in solution should not be applied to the coats of animals that are being fitted for the show ring.

The cost of the above compound will vary according to local conditions. The actual cost, based on the price of the oils, would be about 40s. per gallon at the wholesale houses. To this must be added the cost of transportation, containers, and retailers' profits.

* * * *

A RAT GUARD.

(Farm Conveniences.)

To keep rats away from anything that is hung up, the following simple method may be used. Procure the bottoms of some old fruit-cans, by melting the solder which holds them upon a hot stove. Bore holes in the centre of these disks, and string a few of them upon the cord, wire, or rope upon which the articles are hung. When a rat or mouse attempts to pass upon the rope by climbing over the tin disks they turn and throw the animal upon the floor.

* * * *

A NEST FOR EGG-EATING HENS.

(Farm Conveniences.)

In the winter season hens frequently acquire the habit of eating eggs. Sometimes this vice becomes so confirmed that several hens may be seen waiting for another one to leave her nest, or to even drive her off, so that they may pounce upon the egg, the one that drops it being among the first to break it. In this state of affairs there is no remedy, except to find some method of protecting the egg from the depredators. The easiest way of doing this is to contrive a nest in which the egg will drop out of reach. It consists of a box with two sloping false half-floors ; one of these being depressed below the other sufficiently to make a space through which the egg can roll down to the bottom floor. A door is seen in the side of the nest, through which the eggs can be removed. The sloping half-floors are shown by dotted lines. Upon the back one, close to the back of the nest, a glass or other nest-egg is fastened by a screw or by cement. The false floors may be covered with some coarse carpet or cloth, and the bottom floor with some chaff or moss, upon which the eggs may roll without danger of breaking. If the eggs do not roll down at once they will be pushed down by the first attempt of a hen to attack them.

* * * *

HOW TO THROW A HORSE.

(Journal of Agriculture, Western Australia.)

To thoroughly take the conceit out of a horse there is no better way than to throw him. It certainly requires pluck and determination

to throw a horse single-handed, but if done your horse is virtually conquered for good and all. To do this, put a good, strong halter on your horse, take a strap with a ring in it and buckle it round the horse's off foreleg below the fetlock joint; take a rope eight feet long and tie it to this strap; place a surcingle round the horse's body; take up your position on the right side of the horse, bring the rope over the horse's back from the off side; take hold of the rope and pull his foot to his body; take a firm hold of his foot, holding it in that position; then take hold of the horse's halter with the left hand, pull his head to you, and press against his body with your elbow, using the words "Lie down." The majority of horses can be thrown in this way in under a minute, while others, of course, may fight longer. As soon as the animal has been thrown, take the rope that is underneath him; bring it under the surcingle again, and thus you have the rope in position to bring his head over his shoulder. Make him put his head on the ground, and if he makes any attempt to get up pull his head up immediately, which will prevent him from rising. This will give him thoroughly to understand that you are master. Once a horse realises your power over him he will do almost anything a horse can do.—" Horseman."

* * * *

A NON-SLIPPING CHAIN FOR BOULDERS.

(Farm Conveniences.)

One great trouble in hauling boulders or large stones with team and chain is the liability of the chain to slip, especially if the stone is nearly round. By the use of the following contrivance nearly all of this trouble is avoided. It consists in passing two log chains around the stone and connecting them a few inches above the ground by a short chain or even a piece of rope or wire. Connect the chains in a similar manner near the top of the stone. The ends of the draught chains are attached to the whipple-trees in any way desired. In hauling down an incline, or where the ground is very rough, it will be best to wrap each chain clear around the stone, connecting with whipple-trees by a single chain, thereby preventing a possibility of the chains becoming detached or misplaced in any way.

* * * *

OILING THE SEPARATOR.

(The New Zealand Farmer, Stock and Station Journal, November, 1906.)

Many people oil their separators too freely. I have seen attractive little machines made to look old and dirty by too liberal a supply of oil. The parts are not improved by this over-dose, and the floor and room, as well as the standard of the machine, become smeared over in

a very disgusting manner. Keep the separator and its surroundings neat. Have a pride in these things, and you will be surprised at the increased satisfaction you will derive from your work. Use only a light thin oil of high grade, and use it judiciously. What would you think of a man who tried to oil the delicate mechanism of his watch with axle grease? The separator is one of the most delicate machines on the farm, and should have corresponding care.

* * * *

KEEPING THE SEPARATOR CLEAN.

(*Kansas Experiment Station Bulletin, No. 131.*)

In view of the fact that the hand separator is coming more generally into use, it is only wise that farmers should turn their attention to the care of this machine. The fundamental thing in successful butter-making is good cream, and to produce a high grade of cream the dairy utensils must be kept clean.

The following is a summary of the *Bulletin* :—

"A cream separator should be thoroughly washed every time after using. A brush should be used on every part and piece, using 5 per cent. solution of borax or any other good washing powder. Rinse in hot water, or steam if possible. They should then be left to dry when hot. Wiping with an ordinary clean cloth contaminates utensils with innumerable bacteria.

"The bacterial contamination in milk is increased from three to five times by running it through a separator bowl which has been used and only flushed and left standing several hours. If only flushed while using for several days, the contamination increases several times more, and such milk would be likely to be detrimental if fed to calves.

"The use of washing powder in flush water reduces the number of bacteria in the following batch of milk that is run through, and cleanses the separator more than hot water alone, but not sufficiently to warrant that method of cleaning.

"The use of a cream separator that is thoroughly washed reduces the number of bacteria in milk one-fifth to one-fourth. Improper cleaning is detrimental to a separator on account of the rust that accumulates on dirty or damp places. This may shorten the life of the machine many months, depending on the degree of cleanliness employed.

"Running milk through a dirty separator is similar to running it through a dirty strainer, with all of the filth of the previous milking left in it, from 12 to 24 hours. The millions of undesirable bacteria from the dirt, manure, and slime lodged in the separator bowl spoil all the milk, to a greater or less degree, that passes through the machine.

"When properly used, a cream separator is a clarifier and, to a certain extent, a purifier of milk, but when carelessly used it is a source of filth and contamination."

STONE BOATS.

(Farm Conveniences.)

For moving ploughs, harrows, etc., to and from the fields and for many other purposes, a stone boat is far better than a sledge or wagon, and is many times cheaper than either. The boat may be made of plank, six feet in length, one foot at one end being sawn off. Three planks, each one foot in width, will make it of about the right proportion. A railing two by three inches is pinned upon three sides, while a plank is firmly pinned at the front end, through which the draw-bolt passes. A cheaper quality of wood and of shorter length can also be used, and when one set of runners is worn out others can be readily attached without destroying the frame. Oak or maple plank should be used for the best boats, and when runners are used the toughest wood at hand should be selected. Don't think because it is only a stone boat it is not worthy of being taken care of.

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IRRITATION ON HORSE'S COAT.

Horses are sometimes seen to be continually rubbing themselves against the sides of the stable, walls, posts, etc. The irritation may probably be due to the presence of a mange parasite. To effect a cure it is necessary that the posts, etc., that the horse rubs against should be disinfected by washing with a 20 per cent. solution of carbolic. Every part of the animal's body must be washed with soft soap and hot water, the affected parts afterwards to be dressed daily for a week or ten days with the following : Creolin, 3 parts ; soft soap, 1 part ; water, 100 parts.

* * * *

A BRACE FOR A KICKING HORSE.

(Farm Conveniences.)

Those so unfortunate as to own a kicking horse know something of the patience that it requires to get along with it—and will welcome anything which will prevent the kicking and finally effect a cure. The writer knew a horse which was so bad a kicker that after various trials, and after passing through many hands, and getting worse all the time, to be perfectly cured in the course of three months by the use of the device here given. This is a simple brace, which acts upon the fact that if the head be kept up the horse cannot kick. A kicking horse is like a balance, when one end goes up the other must go down. The brace consists of a one-half inch iron rod, which may be straight, or, for the looks, bent into a graceful curve. It is forked at both ends ; the two divisions of the upper end are fastened to the two rings of the bit, while the lower ends fit upon the lower portion of the collar and harness. The upper ends can best be fastened to the bit by winding with wire, which should be done smoothly, so as not to wear upon the mouth. The lower end is secured by means of a strap fastened to the upper loop, and passing around the collar is buckled through the hole

in the lower part of the end of the brace. The brace need not be taken from the bit in unharnessing. Any blacksmith can make such a brace, taking care to have it of the proper length to fit the particular horse. Keep its head at about the height as when "checked up," and the horse will soon be cured.

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RIVERSIDE WATER CO.—WEIR TABLE.

Actual discharges of water for each inch of weir in length, under four-inch pressure, without allowance for end contractions.

Depth of water flowing over weir.	Inches flowing over each inch of weir in length	Depth of water flowing over weir	Inches flowing over each inch of weir in length	Depth of water flowing over weir	Inches flowing over each inch of weir in length	Depth of water flowing over weir	Inches flowing over each inch of weir in length
⅛	0·015	4	2·665	7⅞	7·371	11⅝	13·223
¼	0·043	4⅛	2·800	8	7·559	11¾	13·446
⅜	0·079	4¼	2·920	8⅛	7·729	11⅞	13·658
½	0·121	4⅜	3·060	8¼	7·909	12	13·913
⅝	0·169	4½	3·188	8⅜	8·092	12¼	14·305
¾	0·222	4⅝	3·313	8½	8·277	12½	14·754
⅞	0·280	4¾	3·462	8⅝	8·458	12¾	15·190
1	0·341	4⅞	3·588	8¾	8·642	13	15·638
1⅛	0·409	5	3·738	8⅞	8·825	13½	16·550
1¼	0·476	5⅛	3·871	9	9·013	14	17·479
1⅜	0·553	5¼	4·021	9⅛	9·200	14½	18·422
1½	0·628	5⅜	4·158	9¼	9·392	15	19·383
1⅝	0·704	5½	4·300	9⅜	9·575	15½	20·365
1¾	0.792	5⅝	4·459	9½	9·775	16	21·354
1⅞	0·875	5¾	4·600	9⅝	9·967	16½	22·363
2	0·978	5⅞	4·759	9¾	10·163	17	23·388
2⅛	1·057	6	4·900	9⅞	10·358	17½	24·426
2¼	1·153	6⅛	5·054	10	10·550	18	25·480
2⅜	1·250	6¼	5·215	10⅛	10·754	18½	26·550
2½	1·347	6⅜	5·366	10¼	10·950	19	27·633
2⅝	1·420	6½	5·538	10⅜	11·175	19½	28·730
2¾	1·520	6⅝	5·692	10½	11·355	20	29·844
2⅞	1·625	6¾	5·863	10⅝	11·559	20½	30·969
3	1·733	6⅞	6·017	10¾	11·759	21	32·109
3⅛	1·838	7	6·175	10⅞	11·975	21½	33·264
3¼	1·958	7⅛	6·350	11	12·175	22	34·430
3⅜	2·065	7¼	6·513	11⅛	12·283	22½	35·311
3½	2·188	7⅜	6·692	11¼	12·592	23	36·805
3⅝	2·304	7½	6·854	11⅜	12·809	23½	38·009
3¾	2·429	7⅝	7·020	11½	13·009	24	39·230
3⅞	2·545	7¾	7·204				

One miner's inch under 4 inches pressure above centre of opening flows in

One sec.	..	0.02 cub. ft.	=	0.1496 gall.
,, min.	..	1.2 ,, ,,	=	8.976 ,,
,, hour	..	72.0 ,, ,,	=	538.56 ,,
24 hrs.	..	1728.0 ,, ,,	=	12925.44 ,,

One cubic foot per second = 50 inches under 4 inches pressure.

DIARY FOR FARM, GARDEN AND ORCHARD.

NOTES ON THE FARM.

By Alex Holm
(General Manager, Experimental Farm, Potchefstroom).

May.

The aspect of the high and middle veld districts generally changes early this month upon the advent of frost. Growth is checked and the natural food of live stock soon suffers deterioration.

Stock.—In most districts the grass will still be good enough to maintain the condition of the live stock. The young growing stock of all kinds should receive careful attention lest they be allowed to fall off in condition. This is a desirable time for serving sows, in which case they will farrow when the cold of the winter has ceased, and the offspring will have the advantage of the following summer for their growth and rearing at little expense. A sow farrows in from 16 to 17 weeks after being served. If well-matured and well-developed, young boars and gelts can be allowed to serve and be served at 8 or 9 months old.

Crops.—The sowing of oats and wheat on irrigated land can be continued. The harvesting and storing of the mealie crop in the most favourable weather will be continued. If mealies are shelled and bagged at once, care should be taken that they are dry enough, otherwise they will mould in the bags. A mealie crib is useful for storing the cobs when it is not desired to market or consume the grain at once. In this country, where timber is dear, inexpensive and serviceable "cribs" can be made with ½ in mesh strong wire netting supported by lathes of 3 inch x 1½ inch, and an "iron" roof to protect the cobs from the weather.

The summer crop of potatoes will now have matured and may be raised for immediate disposal. Care should be taken not to allow them to be exposed to the frost. If it is desired to retain them until spring they will, in most districts, keep well and sound in the ground in which they have been grown. The price of potatoes is generally much higher in spring than in winter, but if the crop is affected by the potato tuber moth it is advisable to raise it at once and sacrifice the higher price which might be obtained. In very cold situations it might be necessary to raise the crop before winter and clamp them in long narrow pits covered with straw or grass and outside this a few inches of soil.

Land generally ploughs well at this time of year before it becomes too dry and hard. Veld which is to be brought into cultivation should be ploughed about this time, and cross-ploughed in the spring before sowing the crop. Especially if the spring rains are late and light, land

broken up early in winter can be brought into a better state of cultivation and at an earlier date for sowing the crop than if the breaking up process is left till spring. The spring rains are also retained by the soil when the ploughing is carried out early, and the summer crops are consequently less likely to become drought stricken.

Select the best land on the farm for "cropping" purposes, as it seldom pays to "crop" soil of inferior quality.

JUNE.

This is the "dead" month of the farmers' year. Practically all growth is arrested by the cold of the winter, and the length of the working day is shortened.

Root crops will now be ready for use and will be found a valuable adjunct to dry fodder especially for breeding stock and for young growing stock of all descriptions.

The sowing of crops should be discontinued for the present, and the attention of the farmer should be devoted to the completion of the harvesting of the mealie crop, the care of live stock, and the repair of roads, buildings and fences. On irrigated holdings irrigation will probably be required early in the month unless an unusual shower of rain keeps the crop supplied with moisture. The advisability of irrigating during frosty weather is often raised. The experience of the writer indicates that no harm is caused to the crop when irrigated during such conditions, but, on the contrary, a crop which has recently been irrigated is not checked so much by frost as one borne on land which is dry on the surface. Ploughing for the following season's crop should be pushed ahead, and accumulations of manure should be carted out of kraals, buildings, etc., and applied to the land direct or hauled to a heap for application at a later date.

Farmyard manure should be applied in the following method :—Mark out the field in straight lines, 10 yards apart, with a plough. Off-load the manure from waggons or carts into heaps along these lines at distances of 7 yards apart. It will be found convenient to throw off a heap from each end of an ox waggon, which gives the required distance. Make from 15 to 20 heaps from each waggon load. This will give a dressing of from 8 to 10 tons per acre—an average application on soils of fair fertility.

In the harvesting of the mealie crop select from the main bulk the best cobs and those most true to type for next season's crop, and, as time permits, have the irregular grains removed by hand from the top and bottom of the cob, retaining only the remainder for seed. Cobs which are well filled at both ends, which have the grain closely packed in straight rows, whose core is not too thick in comparison to the size of the cob, and whose grains are fully matured are the best to keep for seed purposes. The yield can be greatly increased by the careful selection of the seed.

The threshing of other seed or grain crops, such as Kaffir corn, manna, etc., should be proceeded with now when the other work of the farm is less pressing.

JULY.

Though heavy frosts may still be expected, some signs of growth may be seen in irrigated crops.

Stock.—Continued care and attention is required, especially to keep them in good healthy growing condition. Free access should be given to troughs containing salt with the addition of a proportion of bone meal. Rock salt provides a good "lick," but the ordinary coarse salt obtained in the country will be found much cheaper and apparently just as effectual.

Young pigs are liable to become stunted in growth and generally unthrifty at this time of year owing to the cold and to the want of green food. They should have a warm bed of grass or straw to lie on, and, if no succulent food such as roots, pumpkins, silage, etc., is available, give an occasional dose of about ½ oz. per head of sulphur in the food, which should consist of a mixture such as mealie meal and barley meal, in preference to the former alone.

Milk is generally expensive and in great demand during the winter months, and farmers near town or within railway communication thereof would be well advised to endeavour to supply the demand at this season. With proper management to regulate the calving of the cows, say, in April, May and June, and the provision of winter fodder by attention to its growth during the summer season, the production of milk might become a much less expensive item than it generally is at present. Dairy cows will give a good yield of milk if fed on good hay, roots or ensilage, with the addition of a few lbs. of ground oats, mealie meal and bran, the latter being probably the only feeding stuff which needs to be purchased.

Crops.—Early varieties of wheat may be sown this month to be grown with irrigation, and to mature in November or December.

Oats to be irrigated may also be sown this month, though the crop is not generally so good as that sown in April or May.

The land for the August planting of potatoes should be prepared. The ploughing should be deep—9 inches—and thorough. Unless the land is of good fertility, an application of about 10 tons per acre of dung should be given, and can with convenience and with good results be ploughed in. Artificial manures are likely to give the best results when sown on the surface and harrowed in. On typical soils of the Transvaal finely ground bone meal and guano, with or without dung, are calculated to give the best results, and the potato crop well repays liberal manuring combined with good cultivation. Superphosphate and basic slag are also beneficial manures, but, comparatively, they are more expensive manures than bone meal or guano. On this farm lime has not given that expected increase in yield when applied to the potato crop, probably because the water used in irrigation contains lime in solution.

Deciduous trees, such as oaks and willows, should be planted this month. Holes 3 feet in diameter and 2 feet deep, filled with good soil, should be prepared for the former, and, in order to protect the young

trunk from being dried up by the dry atmosphere and by the scorching sun of the following months protect them with sacking during the first season. Willows succeed best in moist situations, and can be easily established by planting in holes 18 inches or 2 feet deep branches or limbs cut off old trees.

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THE GARDEN.

By J. M. Maxwell-Lyte, Assistant Horticulturist,
Potchefstroom Experimental Farm.

May.

The man who wishes to be successful with his flowers must see that his ground is well prepared for receiving his seeds. Naturally, if he takes any pride in his flowers he will, when buying his seed, get the best possible. In so many cases, however, he neglects to prepare his ground till he is practically ready to sow his seeds.

There is ample time during the winter months to have the ground well dug over and treated with well-rotted stable manure, and he will find the extra time and trouble so expended will fully repay him and make a success instead of a failure of his garden.

By sowing seeds in the late autumn and early spring he will find that the seeds have a longer season to grow than if they are "forced" by the early summer sun, and hence are hardier plants. Those varieties which are naturally more tender than the hardy annuals should be sown in the spring and be carefully covered with light grass or sacking if there is a likelihood of a frost during the night.

A common fault in sowing seeds is to bury them.

The finer the seed is the less covering it will require, and at no time should they be covered with soil more than three times their own size. To sow seeds, especially fine ones successfully, a good plan is to mix the seeds with some soil or sand to the quantity of a cup full to an ounce of seed, which should be well mixed; this will ensure even sowing. He should see that his seed bed is well raked, and it is advisable to sprinkle it over with water out of a fine rose watering can an hour or so before sowing.

When the seeds have germinated too much trouble cannot be taken over thinning as the young plants come up, as it is impossible for them to make satisfactory roots if overcrowded. As soon as the young plants are big enough to catch hold of in the beds they should be thinned, and this operation continued till you have all your plants at the requisite distance apart. The system of running water over the young seeds is very apt to wash them out or drive them to the far end of the seed bed, leaving the upper end denuded.

In ordinary weather watering every evening with an ordinary hose or watering can will be sufficient. In exceptionally dry weather this

will have to be repeated in the morning also. The seeds, when germinated, should be shaded with grass, light boughs, or canvas, 1 to 1½ feet from the ground, supported on stakes, till they are strong enough to stand the rays of the sun. Sacks or sacking should not be placed over the young plants during the day as they are impervious to light, which is so essential to hardening the young plants.

Any weak plants should be carefully staked.

The following kinds of seeds can be sown now in the open, except where otherwise mentioned :—

Flower Seeds.

Sow this month :—

Acroclinium.—A hardy annual which blooms from early spring till the first frost.

Antirrhinum.—Better known as Snapdragon. A useful flower for table purposes owing to the variety of its colour.

Calliopsis.—A beautiful border plant, and a free bearer, having flowers of a golden hue standing 2 to 2½ feet high.

Campanula or Canterbury Bells.—An old English plant which is still a great favourite. This plant, owing to the weight of its foliage, is very apt to snap in the wind, and should be planted in a sheltered position. Useful varieties : Media Calcanthemum and Speculum.

Candytuft.—Easily raised and transplants well. Varieties : Empress, White Rocket and Purpurea.

Centaurea or Cornflower.—The favourite flower of the German nation. Flowers freely ,but apt to become a weed. Varieties : Depressa, Cyanus, Emperor William.

Convolulus or Morning Glory.—Is a good climber for covering unsightly fences, but chokes any other flower plants growing near it. Seeds freely also.

Cosmos.—This is rapidly becoming a bad weed, but a little seed of the variety "Klondike" might be sown and watched at end of season. This variety has beautiful foliage and a grand golden flower 2 to 2½ inches across.

Dianthus.—Sow in tins for planting out. Will bloom all the season. Cut down the plants when they run to seed, and they will spring up from the roots again. Will last from two to three years and transplant well. Varieties : Chinensis, Heddewigii, Mourning Cloak, Imperalis, Semperflorens.

Digitalis or Floxglove.—A little tried plant out here. Does well in the Western Transvaal.

Vegetable Garden.

Asparagus.—Asparagus should now be cut down and given a good top dressing of stable manure. New beds can now be dug in any rich light soil to the depth of 18 inches, and the bottom and centre of the trench should be well dressed with good stable manure. The most economical width for such a bed is 5 feet, which will take three rows,

one down the centre with one on each side a foot from the edge. This bed should be kept clean of weeds, and be ready for spring planting.

Beets.—Drill your seed 2 inches in light soil and 1 inch in heavy in drills drawn 18 inches apart. Thin later to 6 inches. Care should be taken that the ground has been ploughed or trenched to at least ten to twelve inches, so that the roots can descend and not fork. "Crimson Globe" does very well on the High Veld. Seed, 2 ozs. to 100 feet of row.

Broad Beans.—Drill 3 inches deep, setting four beans in each hole in beds 4 feet wide, and the rows 2 to 2½ feet apart. Nip the tops to ensure early maturity and as a preventative to black aphides damaging the young pods.

Carrots, Dutch.—Your soil should have been dug over and manured in December if you want a really heavy crop. You can sow on the ground which has yielded potato crop, as the ground still retains some of manure previously applied. Drill the seed in rows a foot apart and about an inch deep. Keep the ground well hoed and thin when the plants are very small, then again when the plants are big enough for eating. Four to five lbs. to the acre according to the variety. 1 oz. to 100 feet of drill.

Corn Salad.—Drill in rows 6 inches apart and thin to 6 inches in the row. Sow largely as this comes in season when lettuce is over. It is ready for cutting eight to nine weeks after sowing.

Cabbage.—This is the month to transplant cabbages. Set in rows 2 to 2½ feet apart. Dip in lime water as a preventative against blight. Dust the plants over with lime from time to time, and don't stint the stable manure or bone dust. Avoid planting them where turnips or any of the brassica tribe have been previously. Sow a small bed for transplanting later. See that your ground is well mulched with rotten manure well dug under, and the surface well pulverised. Don't sow too thickly, or else you will have weak plants. If the season is dry water twice a week. 1 oz. to 1,500 plants. ½lb. per acre.

Celery.—The young plants should be ready for transplanting this month. Care must be taken to raise them with a ball of soil, and they should be planted in trenches 16 to 18 feet deep, at a foot apart. They should be sheltered from the sun for the first few days, and water and liquid manure must not be stinted. As they grow they must be banked up to blanch them, and a month before cutting should be banked up to the tops of the stem. Half paraffin tins answer this purpose well and save labour. 1 oz. to 1,500 plants.

Endive.—Sow in a carefully prepared seed bed. Lift the young plants with a good ball of soil. Plant in rows 1 to 1½ feet apart. When 10 inches high choose a dry day and tie the heads up with raffia grass to blanch them, and keep them well watered. They will be found a very useful salad for the winter and early spring.

Leek.—Leeks should be sown in a seed bed, and when the size of a goose quill should be planted out in rows 9 to 12 inches apart. A stake can be used for dibbling them and at transplanting the leaves should be shortened to a third, and the young plants set lightly in the

dibbled holes and the ground hoed round. Gradually bank them as they grow, and don't stint the water if weather is dry. If you want show leeks plant as celery and tread the tops down a few weeks before collecting. 1 oz. to 600 plants.

Lettuce.—This can be sown most of the year round, and should be grown in a well-prepared seed bed, richly manured. Transplant into rows 18 inches apart and plant at 1 foot apart in the rows. Lettuces are crisp only when quickly grown. Amongst other varieties sow some asparagus lettuce which can be cooked and used as a substitute for asparagus.

Onions (Dutch, Uijen).—Sow as leeks and dibble at 3 to 4 inches apart in the rows.

Parsnips (Dutch, Pastinaak of Witte Wortels).—Drill in rows as carrots. 1 oz. to 2,000 plants.

Parsley.—Select a shady seed bed and thin to 2 feet apart or plant in rows 2 by 2 feet. 1 oz. to 100 feet.

Raddish.—Sow these thinly in beds every 10 to 14 days to get a succession. They can also be sown in rows 8 inches apart, covering the seeds say ½ inch deep. If dry weather apply a little water at night and morning with a watering can. 1 oz. to 100 feet.

Rhubarb.—No stalks should be cut the first year, and seed stalks should be cut off. Plant as celery.

Spinage.—Sow in drill 18 inches apart and later thin to 12 inches. Sow the round spinage for summer and the prickly for winter. The spring and summer plants need only stand 6 inches apart. Continue your sowings once a month till the ground becomes too hard, then sow spinage beet. Useful varieties: Goliath, New Zealand (which should be soaked in boiling water before sowing), and which can be transplanted; Prickly and Monstrous Viroflay. 10 lbs. to the acre. 3 ozs. to 100 feet.

Turnip (Dutch, Raap).—Sow in loose, sandy soil either broadcast or in drills. The drills should be 15 inches apart and the young plants, when 2 inches high, should be thinned to 6 to 9 inches. The white varieties are the most suited to the autumn and spring sowings and the yellow for summer. Keep the plants well hoed, and keep all weeds down. It is not advisable to over treat the ground with manure, as turnips are very apt to grow coarse. Water once a week if the weather is dry. 1 oz. to 100 feet.

Eschscholtzia or Californian Poppy.—Useful for borders growing a foot high. Must have a sunny aspect. Varieties: Californica and Mandarin.

Gaillardia.—A very useful flower for cutting owing to its lasting propensities.

Godetia.—Will grow practically anywhere. Varieties: Ducheses of Albany, Gloriosa, Lady Albermarle and The Bride.

Larkspur or Delphinium.—A hardy annual. When planted out should be set 2 feet apart, and act as a background. Famous for its great variety and beauty of colour.

Linaria or Kenilworth Ivy.—A good border, and suitable for rockeries.

Linum.—Flowering flax. Varieties: Rubrum, Flavum and Perenne.

Lupin.—Varieties obtainable in white, blue and yellow.

Lychnis.—A useful herbaceous plant, producing flowers in clusters.

Marigold.—One of the commonest plants out here. Grows densely and is useful in large beds.

Mignonette.—No garden should be without this old favourite, owing to its fragrant perfume. Easily grown, but prefers a little shade and should be kept moist. Makes a splendid pot plant. Varieties: Golden Queen, Machet, Goliath, Bismark and Victoria.

Nasturtium.—Sow these in less rich soil, as they are apt to go to leaf. When firmly established they make a great show.

Nemophila or Love in the Grove.—Grows to 6 inches in height, and blooms well if sown in a shady place in soil none too rich. Varieties: Insignis and Insignis Alba.

Phlox Drummondia.—Do not sow too thickly. Sow mixed varieties to get all shades from pure white to deep crimson.

Stocks.—Plant out now for spring blooming. Will not do well if sown after March.

Sweet Peas.—An excellent article on these will be found in the "Agricultural Journal," Vol. IV., page 665.

Ampelopsis Veitchi.—Sow some seed of this well known Virginia creeper for transplanting against unsightly walls or buildings. In autumn it changes its leaves from yellow to deep crimson bordering on black.

Dahlias and chrysanthemums, if not already cut down, should be, and the dahlia tubers dug up and stored in any dry shed or loft in mould or sand, as mice and other ground animals are very apt during the winter to attack the roots.

See that you leave one eye when you are dividing each tuber. Chrysanthemums after being cut down may be left in the ground so that the young shoots can be utilized when the bedding out season comes round. The old plants, when subdivided, can be replanted in fresh well-prepared ground, or else placed in tubs as stoep plants.

JUNE.

Flower Seeds.—Sow Antirrhinum, Candytuft, Calundula, Centaurea (Cornflower), Carnation, Daisy, Dianthus, Gaillardias, Marigold, Mignonette, Nasturtium, Pansy, Petunia, Phlox, Sweet William, Wallflower.

Vegetables.—Sow Beet, Broad Beans, Mustard and Cress, Leeks, Lettuce, Onions, Peas (small quantity), Parsnips, Radish, Turnips.

JULY.

Flower seeds as June.

The pruning of all rose bushes should be complete this month, and the year's growth in the dwarf varieties should be cut back to four to six buds.

Remove the soil round the plants and give them a good dressing of rotted manure mixed with loomy soil if procurable.

Young rose trees should be planted this month.

On arrival of same make no delay about planting as they dry out very quickly.

Cut your young roses down to three main branches, and the branches to 2 to 3 inches. Plant at the same depth as in the nursery where they came from. Spread out the roots well, having cut off any damaged root ends there may be, and see that the roots are not resting on pure manure, but that there is soil between the manure and the roots. Bank loose earth right up round the stem covering the bud.

Vegetables.—Same as June.

Tomatoes.—Raise in a hot bed and do not let them trail on the ground, but stake them, or else the early fruit will get damaged. Keep them well moist, and nip back the shoots in front of a joint when the plant starts to flower and fruit. Give them plenty of room when planted out.

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THE ORCHARD.

MAY.

Deciduous Trees.—Towards the end of this month winter pruning may be commenced. This is really the most important of orchard operations, and should by no means be neglected. Upon it depends, not only the shape given to the tree at the time of cutting, but also the building up of the framework of branches for future years. The productiveness or otherwise of many kinds of fruit trees also depends largely on the pruning, as also does the size and quality of the fruit which will be borne. On all young apricot, nectarine, peach, pear, plum and apple trees pruning is imperative, if ordinarily good results are to be obtained. As the peach and nectarine trees attain age, cutting need not be so severe, but on the remainder of the sorts named a certain amount of pruning is always necessary. If pruning is followed up persistently, year after year, one will never see the small undersized fruits so often found in our markets at present. The removal of all dead and badly developed wood, together with all branches that cross and rub one another, is to be commended, and all dead spurs may also be cut off. Trees suffering from scale of any kind, or those which have borne scabby and unsightly fruit last season may be sprayed.

Citrus.—Early oranges should now show signs of ripening, and care in picking, handling and packing must be given if the best results are to be obtained. In all cases fruit should be cut from the tree and not plucked. When this is done the oranges keep longer than happens when the stem is torn off, and meet with a corresponding amount of favour from the purchaser. In handling they should not be thrown about roughly, but each fruit, as cut, should be placed, not thrown, into the picking basket or bag, thus obviating bruising.

Lastly, fruit with which such care has been taken should be sent to market in boxes of some kind. If you do not care to purchase special orange boxes, use old paraffin cases, or egg baskets or any boxes you can obtain rather than throw the fruit pell mell into the bed of a wagon. You can have your boxes returned, and a small outlay on the purchase will repay itself perhaps ten times in the course of the season. If you have never tried this, do so now. You will not regret it. If you continue to haul in your fruit loose in the wagon, bumping and bruising at every jolt, do not be surprised if you get small prices even if your oranges are bigger and better and sweeter than your neighbour's, who takes pains to pack properly, and yet gets a higher figure than you do. Irrigation of late kinds may be continued, but for early and medium sorts the last watering should have been given some time since.

June.

Deciduous.—Winter pruning should be in full swing now, and will last, in many cases, throughout the month. Attention may be given to the laying out of new plantations and the digging of the holes for tree planting. On no account should a less distance be allowed between the trees than 20 feet in each direction, and apples should get at least 24 feet between each tree. This is the best month for winter spraying, which is often necessary for many reasons. Where scale of any kind is present it is now most exposed to the attack of the spray pump, and good work is assured owing to our dry winter season. Spraying with the Bordeaux Mixture is advisable as a preventive against some fungus diseases, such as "shot hole," etc. It is also a certain preventive against the "curl leaf" of the peach.

Citrus.—Work in this line will be principally confined to gathering in the crop. Last month's remarks about cutting instead of plucking the fruit from the trees cannot be too strongly emphasised; whilst the packing of all citrus fruits, oranges, naartjes and lemons in boxes is likely to improve prices realised.

July.

Deciduous.—All prunings and other rubbish should be carefully collected and disposed of. Burning or burying are the best methods of doing this. If they are burnt, care should be exercised not to make too large fires so as to scorch the surrounding trees, and the ashes should be thrown broadcast over the ground. If buried, as is largely

practised in the Cape Colony vineyards, they may be placed in trenches dug lengthwise between the rows, in the centre between the trees. You thus return something to the land which will in time decay and later become a plant food.

July is the month when nine-tenths of the deciduous fruit trees set out in this Colony are planted. In planting, be sure and get good large holes made of not less than 2 feet square. The tree should be planted so as to get the "bud" level or slightly above the level of the ground—water will be needed at intervals until the rains commence. After planting, all trees should be cut down to one level, preferably about knee high, then when they get to be a few years of age you have one uniform length to all the trunks, in addition to keeping the head of the tree down low, thus shading the trunk, and rendering the operation of picking fruit, pruning, etc., more easy. This is also a good month for spraying.

Citrus.—Operations in the citrus grove will still consist largely in the harvesting of the crop.

EDITORIAL NOTES.

The Sheep Industry of Australia.

Within the past two years a considerable sum of money has left South Africa for the purchase of Australian merinos; and it may be of interest, at the present moment, to sketch the rise of the Commonwealth as a sheep country. The pastoral industry is the chief element in the wealth of the Island-Continent. Since 1851 the export of wool from Australia has reached the startling total of £610,000,000 sterling, or more than £230,000,000 in excess of the gold production for the same period. And for the year ending 1906 the wool export reached the magnificent figure of 480,240,017 lbs., valued at £22,669,803.

* * * *

Yet the beginning of this great industry was humble enough. The first organised settlement of Australia took place in the year 1788; and history records that Governor Phillip took with him from England 1 bull, 4 cows, 1 calf, 1 stallion, 3 mares, 3 foals, 29 sheep, 12 pigs and a few goats; and although the whole of the present flocks and herds of Australia have not sprung from these same animals yet the figures show the small scale on which stock raising was first begun.

The following numbers will show at a glance the rise of the sheep industry:—

TABLE I.

Number of Sheep in Australasia at Various Dates.

Year.	Sheep.
1792	105
1800	6,124
1851	17,326,021
1891	106,400,000
1904	84,106,590

* * * *

It is to Captain Macarthur that the credit is due of having been the first to prove that the production of fine wool could be made a profitable industry in New South Wales. In the year 1797 he procured from the Cape of Good Hope, at great cost and trouble, a number of fine rams and ewes. A fortunate circumstance favoured his enterprise, for he had the good luck to secure three rams and five ewes of the purest Spanish breed which had been presented by the King of Spain to the Dutch Government. These animals, out of a total of 29 purchased at the Cape, duly arrived in Sydney, and were disposed of to various breeders. Macarthur thought little of present profits. He watched closely the results of crossing his imported rams with the old stock, and by systematically selecting the finer ewes for further mingling with the best sires he gradually improved the strain; and in a short time the texture of his fleeces met with a ready response on

the part of the English manufacturers. Prior to the present century the finest wool came from Spain; and it was at this opportune moment that Macarthur arrived in England with wool. In this way he opened up with the English manufacturers a trade which has been growing in volume ever since. During his second visit to England Macarthur purchased another stock of ten rams and ewes of the famous Spanish merinos. That these animals were amongst the best in Europe may be learned from the fact that they had also formed portion of a present from the King of Spain to George III.

* * * *

On his return to New South Wales, Macarthur patiently continued the process of selection with such success that in 1858, when his flock was finally sold, it was estimated that his superior ewes numbered fully one thousand. Victoria secured a large part of his flock, and from this time on may be dated the marvellous rise of each of the several States. It was then that the first settlers heard the call of the desert, passed into the unknown plains of the interior; spread their dominion over the treeless solitudes till at last the voice of the "Station" resounded from the Gulf to Adelaide and from Toowoomba to the Gascoyne.

We do not know if any monument has been erected to the memory of this pioneer breeder; but we should like to think of a noble column erected by national subscription and set upon some proud eminence in the heart of the sheep country to the man who first pointed out to his countrymen the path to great wealth and high honour; and who, by his own unceasing toil, laid the foundation of that industry which has raised the Commonwealth to the rank of a great nation, given food and clothing to the countless poor, and conferred a blessing upon all mankind.

* * * *

None of the States of Australia is stocked to its full capacity. Indeed, in the extensive territory of Western Australia and in the Northern Territory of South Australia the process has just been begun. The best way of getting a clear idea of the extent to which each State is stocked is by reducing the different animals to some common denomination. Assuming, therefore, that one head of large stock is equivalent to ten sheep, and expressing the cattle and horses in terms of sheep, it has been estimated that the number of acres to a sheep in each State is as follows:—

TABLE II.

State.	No. of acres per sheep.
New South Wales	3.8
Victoria	2.3
Queensland	11.5
South Australia	45.4
Western Australia	74.3
Tasmania	4.4
New Zealand	1.8
Australasia	11.0

From this table it is evident that the most closely stocked State in the Commonwealth is Victoria with 2.3 acres per sheep, but this is by no means the limit to the carrying capacity of that State ; on the contrary there is still a large tract of country to be brought under the sway of the pastoralist.

New Zealand is stocked to a slightly heavier extent, but neither that Colony nor New South Wales, which averages 3.8 acres per sheep, can be said to have reached its full carrying capacity. If the 1901 average of New South Wales, viz., 3 acres to a sheep, be taken as the possible limit to which Australasia may be stocked, there is room in these States for nearly 450,000,000 sheep or 45,000,000 more than were then depastured.

* * * *

That Australia could carry 1 sheep to 3 acres is, however, at present improbable ; for in almost every State the best land is being taken up, and the ever increasing demands of the farmer must necessarily lessen the area at the disposal of the grazier. This will prove true, more particularly, of Victoria, New Zealand and Tasmania. On the other hand, by resisting the temptation to overstock poor country by subdividing large flocks, and by increasing the natural carrying-capacity by the conservation of water ; by irrigation as well as by dry land tillage ; by the artificial cultivation of good grasses still larger numbers of sheep will undoubtedly be pastured and the enormous figures given in the proceeding paragraph may ultimately be reached.

The number of sheep depastured in the Commonwealth increased with great regularity each year until 1891, when it reached the magnificent total of 106,400,000 ; since that year up till 1903 there has been a dreary succession of bad seasons in New South Wales and Queensland, with the result that the number of sheep decreased by 44,000,000 in a single decade ; while in Queensland alone in one year close on 5,000,000 sheep succumbed.

* * * *

The evil effects of these adverse seasons have caused renewed attention to be devoted to the problems of water conservation and irrigation. That much can be done in the way of providing fodder during the dry season has been shown in several instances. At Forbes, in New South Wales, 22 acres of irrigated lucerne kept 1,600 sheep in good condition for a period of four months prior to the breaking up of the drought, whilst at Rodney, in Victoria, the farmers who used the water of Goulbourn for irrigation purposes were able to send fat stock to the Melbourne and Bendigo markets in addition to supplying the squatters of Riverina with lucerne and other fodder for their starving stock. It is not alone the actual loss of stock that makes a drought so disastrous, but the fact that, even with the return of good seasons, a long period elapses before the country regains its full carrying capacity. Be that as it may the wonderful recuperative power of the Commonwealth has again been shown by the recent bountiful

harvests, the luxuriant herbage, and large lambing returns. In the year 1903 Australasia again resumed its position as the foremost pastoral country in the world.

* * * *

As illustrating the predominance of the merino in Australia and the cross-bred in New Zealand it is interesting to note that of the Australasian cross-bred wools catalogued in London in 1903 only 15 per cent. came from Australia, while New Zealand furnished 85 per cent. The first successful attempt at shipping frozen mutton to England was made by New Zealand in 1882, and since then this trade has reached an enormous volume. Last year the value represented more than £4,000,000 sterling.

Taking a census of the last 16 years the highest price realised for New South Wales and Victoria wool was during the year 1899, namely 13d. per lb., and 15½d. per lb. respectively. The lowest price, viz., 6d. for New South Wales and 7½d. for Victoria was experienced in 1895. The average for the whole period has been 9½d. per lb. for New South Wales and 11½d. for Victoria merino.

The following table shows the number of sheep in each State of the Commonwealth and New Zealand at the end of 1904 :—

TABLE III.

State.	No. of Sheep.
New South Wales	34,526,894
Victoria	10,167,691
Queensland	10,843,470
South Australia	5,874,979
Western Australia	2,856,290
Tasmania	1,556,460
Commonwealth	65,825,784
New Zealand	18,280,806
Australasia	84,106,590

* * * *

The wool-clip of New South Wales is the most important item of production, and it may be said that the prosperity of the State in a large measure depends upon the wool market. Taking the average annual export of this State at 250,000,000 lbs. the rise of 1d. per lb. in the market price means an addition of £1,041,000 to the wealth of the people. Of late years great attention has been given to the question of breeding, and the result is seen in a marked increase in the weight of the fleece. In the period 1881-1885 the average yield of wool per sheep was 5.24 lbs., while in 1901-1904 it had risen to 7.62. On the whole New South Wales is comparatively free from disease. At the first sign of any serious outbreak a Government veterinary surgeon is despatched to the scene. The chief diseases of sheep recorded during the last ten years were anthrax, foot-rot, fluke, worms and the black

disease. *Scab has been unknown for many years.* The mortality from anthrax was considerable until M. Pasteur's system of vaccination was introduced. Over one million sheep are now successfully vaccinated every year as a preventive measure against this disease.

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It will be of interest to our farmers to know that Mr. Christopher H. Rowan, late of Jemalong Station, Lachlan River, New South Wales, has been temporarily appointed as an expert sheep-classer and wool sorter. Mr. Rowan has already visited various centres such as Volksrust, Amersfoort, Bethal, Ermelo and Standerton instructing sheep growers in the sorting and management of wool and in the grading of their sheep. The meetings have proved most successful, and have concentrated attention on the whole question of wool. Such practical demonstrations are much appreciated by the farming community, and will do more good than years of legislation. Regarding his recent tours on the High Veld Mr. Rowan speaks as follows :—The wool in the districts from Volksrust to Lake Chrissie is, on the whole, a very good wool. It is principally medium to strong in character ; it is a well grown long staple, but far too loose, big bodied sheep only cutting very light fleeces. Again, we find half-a-dozen different types of wool on one farm, which is very bad. This is due to lack of sheep classing. Our aim must be to grow a uniform wool from medium to strong. The bulk of the High Veld is better than the average Australian sheep country, because it is cleaner, that is, it is freer from burrs and harmful grass seeds. Further the grass is sweeter. Undoubtedly, it is a good sheep country. But the farmer of the Transvaal pays too much attention to length of staple. He must strive to obtain wool of a closer texture in order to withstand the cold winds, dust, and wet of the High Veld of this Colony.

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Co-operative Creameries.

At a time when there is a movement towards the establishment of Co-operative Creameries in this Colony, it may be instructive to depict the growth of this industry in two famous dairying countries, namely, New Zealand and Denmark. And at the outset it is worth while to recall that the area of New Zealand is 104,751 square miles ; Denmark only 15,360 ; while that of the Transvaal is 111,196. It is a well-known fact that during the past decade the making of butter and cheese has done much to promote the welfare of New Zealand ; but it will come as a surprise to most people to learn that the farmers of the Island Kingdom exported last year butter and cheese to the value of £2,072,591. Although New Zealand is the natural home of the dairy cow, yet in the early days there were few who would have cared to prophesy that the industry would ever reach its present world-wide renown.

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The making of cheese by the factory system was first started in the South Island at Edendale, and in the North Island at Featherston.

It was, however, many years later before butter and cheese factories were started by the farmers themselves on co-operative lines. In the early days of the industry it was a difficult matter to finance co-operative factories. In any country where a new industry is starting it is hard to convince people of its probable success. So it was in the early days of New Zealand. Financial houses at that time were cautious, and did not display much confidence in the future success of the industry. All this, however, has long since disappeared.

To-day any bank will readily advance money to a body of farmers who form themselves into a Co-operative Company and sign a joint guarantee to the bank.

Under this system of raising capital for the starting of dairying, it is only necessary to call up a small amount of cash on the shares held by the farmers, the bulk of the capital being obtained, and the liabilities discharged by a small deduction being made from the monthly milk cheques of the shareholders ; that is to say ⅛d. or ¼d. per lb. of butter fat is deducted from the farmers' cheques until such liabilities are cleared off.

The bulk of the dairy business is carried on in large central butter factories which are situated in the centres of good dairying districts. These large factories are fed by branch separating stations which are situated in the surrounding districts. Many of the factories have from 4 to 10 of these separating stations, while a few have as many as 40 ; but it is not wise to extend the business too far, for this means deterioration of the cream in transit and must result in inferior butter being produced at the central factory.

The advantage of this system is in saving individual farmers in initial cost. The separating stations in the outlying districts serve the suppliers just as if they were delivering their milk to the central factory. Then again the larger a butter factory is, within a reasonable limit, the lower the cost of manufacture. There are many other points in favour of farmers combining for the purpose of starting factories. They can afford to build better factories, instal a first-class plant, employ first-class managers, to whom they can afford to pay higher wages than the smaller factories. There is also economy in working expenses and uniformity in the butter manufactured.

The output of butter at some large factories in New Zealand often reaches 1,000 to 1,200 tons per annum. Many of the smaller factories turn out 200 to 600 tons yearly. The dairy industry steadily advances. In 1906 there were 229 creameries (butter factories) and 89 cheese factories.

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The number of dairy farmers supplying milk to factories in the Colony is now over 12,000. The larger portion of these are dairymen pure and simple. Many of the best dairying districts are not well adapted for grain growing, and consequently dairying is carried on almost exclusively in those districts. Most of the farmers delivering milk to factories keep from 30 to 300 milch cows. Of course there are a large number of smaller suppliers. The payment for milk at both

butter and cheese factories in New Zealand is on the butter fat basis, the amount of fat being ascertained by the Babcock test, which is the most practical, reliable and accurate means of ascertaining the amount of butter fat and of distributing the proceeds fairly among farmers. The best milking herds are largely composed of Jerseys and Ayrshires, while Shorthorns of a milking strain are proving good milkers and very hardy and successful as dairy cows. A good many farmers are crossing Shorthorns with Jerseys and Ayrshires. There are also a few Holstein herds. The Colonial or general purpose cow, when properly selected, is found to be an excellent milker.

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The cost of manufacturing butter in New Zealand in co-operative factories varies greatly, and depends largely on how the factory is equipped, the cost of hauling or carting the cream, and, most important of all, the management. In large factories with up-to-date machinery which enables the manager to avoid any loss of butter fat in the skimming and churning process, and where the manager is a competent man and the supply large, the cost of manufacture has been reduced very close to one penny per pound of butter produced. In smaller factories, where the equipment is not first-class and the management not the best, the cost of manufacture runs much higher. Generally speaking, in the ordinary-sized factories, it costs about 2d. per pound.

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It must not be thought that New Zealand dairymen are farming on cheap land. Many farms are sold in the rough state, with standing timber on, for £11 to £17 per acre, and you can safely add another £4 10s. to £6 per acre for felling timber and clearing. This would be in good grass country when cleared. In the best dairying centres where the land is cleared, the growth of grass is enormous. Such land, it has been found, will almost carry one cow per acre. Land in these districts always fetches £25 to £33 per acre. With such enormous prices for land, and the fact that good milkers get from 25s. to 35s. per week, it will be seen that the business must be run on thoroughly practical and scientific lines in order to allow of a profit being made.

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During the past ten years New Zealand has made rapid strides in the direction of improving the quality of her dairy produce, and she now occupies a very high place in the British markets. This great success has been mainly due to the careful fostering of the industry, to wise and effective legislation, and to the constant and generous assistance of Government.

New Zealand has a sound Dairy Industry Act which is stringently enforced. In addition, she has a capital set of export and branding rules as well as dairy regulations which apply to dairy farms and govern the conditions of farm-yards, stables, milking, care of milk, etc. All these Acts tend to greatly improve the milk supply or raw material

before it is delivered to the factories. The New Zealand dairy industry has also benefited by the excellent system of the State grading of produce.

Official inspectors have also done a great deal towards advancing dairying in New Zealand. The New Zealand Government has spent large sums of money in the employment of experts, and to their work the success of the industry is largely due. At present there are nine dairy instructors and graders, and one dairy commissioner.

The other day a merchant in Pretoria informed us that for the past two years he had imported from New Zealand two tons of butter every month. This is only one case amongst the many which go to swell the sum total of our imports of butter and cheese, which for the fiscal year 1906 are valued at £259,076.

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Denmark.

Statistics with reference to the dairying industry of Denmark are illuminating. We are told that some 200,000 farmers in Denmark are engaged in milk production : 2,000 of whom have each 100 cows and over, a large number from 12 to 100 ; while the smaller holders have from 4 to 12 apiece. The total number of cows is well over one million, and last year the value of butter exported from Denmark was valued at £8,650,000. About 98 per cent. of this total export is shipped to Great Britain, and is for the most part consigned to the ports of Grimsby, Hull, Parkeston, Newcastle and Leith. This enormous and ever increasing export of dairy produce is most remarkable, when we consider that the total area of the country is only 15,360 square miles. What is the secret of this conspicuous success? It is to education and co-operation, along with peasant proprietorship. One of the educational authorities in Denmark in discussing the progress of the Danes said that "the mainspring of their success was the policy of 'moving together,' all for each and each for all. Our advance is the movement of the people, the leaders being found in all ranks, from the largest proprietor to the smallest crofter." All ranks and classes feel keenly interested in the success and commercial supremacy of their products. Further, the Danes have shown a ready adaptability to circumstances ; they do not cling to ancient customs and methods merely because they are ancient ; but with commendable zeal and unremitting industry they resolutely address themselves to changing conditions, and with alacrity adopt any innovations which their teachers of science or Government experts may advise as calculated to ensure efficiency.

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For the better understanding of the system of associated dairying it may be well to give here a brief account of the conditions observed in the starting of a creamery. The first necessary preliminary is to ascertain the quantity of available raw material in the shape of milk in the particular district, and the extent to which farmers will be prepared to pledge themselves to secure the requisite capital to enable

the business to be carried on successfully. It is further necessary that the farmers forming the membership pledge themselves to dispose of their milk through their own society. Briefly the obligation on members is threefold; for (*a*) supply of milk; (*b*) the original loan; (*c*) conformity to certain prescribed rules regarding feeding of cows, the treatment of milk and milk utensils. The members appoint a directorate from their own number, usually five to nine, who in turn appoint a chairman, secretary and treasurer, but these offices must never be combined in the same person. The directorate is authorized to contract a loan for the erection of the dairy and the purchase of the necessary plant. For the repayment of this every member is held liable in proportion of the number of his cows, for which he has signed an agreement, until the loan has been repaid. The period for which members usually pledge themselves is ten years, but in some cases seven years is the period agreed on.

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Failure on the part of the members to fulfil their obligations in this respect is of exceedingly rare occurrence. At the expiry of the prescribed period it is found that the original loan is invariably wiped out, and a substantial sum lying at the credit of the Association. Any member wishing to retire from the membership of the society during the first year of its existence pays 20 kroner per cow and 2 kroner less per cow for each year which has expired since the creamery was started. When a farm changes hands, or has been sold, the successor or purchaser invariably takes over his predecessor's obligations and privileges in connection with the creamery. After the original debt on a creamery has been paid off, new members joining are required to pay 10 kroner per cow, for which they sign an agreement, in addition to a subscription corresponding to the amount per cow of the debt paid off. All milk is weighed on its arrival at the creamery, and paid for according to the butter fat it contains. Tests are regularly made to ascertain the fat contents, and payment is made according to the Coperhagen butter quotation.

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Different creameries have different regulations. Some pay at the rate of 1 lb. of butter for every 32 lbs. of milk delivered, others for every 27 lbs. of milk, the idea being to leave a working margin between what is the actual value of the milk and the sum paid to the producers at the end of each month. The profits, after providing for payment of instalment of loan, depreciation on plant and buildings, etc., is divided proportionately at the end of each financial year. The annual general meeting is usually held on the same day as the profit-sharing day, and is usually observed as a sort of festival. Ninety per cent. of the separated milk is taken by the farmers for calf and pig feeding, at an agreed on price, usually ½ to ¾ of an ore* per lb. It is enacted by law that this milk must be pasteurised by being heated up to 180° F. before

* In Danish money 100 ore to the krone. The krone is of the value of 1s. 1½d., or about 18 kroner to the pound sterling.

leaving the creameries. Creameries provide the necessary milk cans for conveying the milk to the creameries. Milk vans are also provided, and the conveyance of the milk is let to contractors. These milk vans pass along the principal roads and collect the milk from the farmers, who are bound to bring it to the main road. In some cases the farmers combine and cart their own milk, and in such cases they are allowed the sum that the creamery would, in ordinary circumstances, deduct for cartage. In summer the milk is delivered twice daily, and in winter once a day. Refrigerators are provided by the creameries for the purpose of cooling the milk at the farms, but in no case must different milkings be mixed, as this seriously interferes with successful butter-making.

Stringent rules are laid down by the creamery directors as to the feeding of the cows, and all foods calculated to impart an objectional flavour to the milk are strictly forbidden. The milk of newly-calved cows must not be sent to the creamery until three days after calving, and in some cases five days ; and the milk of cows suffering from any disease must not be delivered at the creamery unless accompanied by the certificate of a veterinary surgeon. Severe penalties are imposed for non-observance of these and other rules. Cards are circulated amongst the members containing the printed instructions to be observed both as regards the feeding and general treatment of the cows, and also the milking of them. These cards are invariably found suspended in the byres. To the credit of the Danes it must be said that seldom or never have these penalties to be imposed, the loyalty and fidelity with which they carry out the rules of their own organisation being a strong feature in their system of co-operation. Their welfare and prosperity as a nation and community depend on the successful development of their respective industries, and any member attempting fraud or found guilty of carelessness, to the prejudice of his fellow-members, would more than likely have a rather unpleasant experience. In this way it is claimed that co-operation is doing much towards developing Danish character.

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Apart from the great creamery at Trifolium, the capital required to start an average Danish creamery is from £1,200 to £1,500, including buildings, manager's house, plant, etc. ; and the average turnover will be, roughly, the milk of, say, 800 cows. In many of the co-operative dairies the management is farmed out to the manager : thus a gross sum is paid to him, calculated on the turnover, out of which he pays the wages of the other employees, the balance, together with house, coal and light, going to make up his own remuneration. There are, however, obvious objections to this plan, and amongst thoughtful men the system is not considered quite satisfactory. From figures obtained it may be gathered that about 25.5 lbs. of milk produce a pound of butter, and the price paid to the farmers for their milk would be 4.17 ore per lb., or almost 6d. per gallon all the year round, exclusive of profits. The charge for cartage of milk to the creameries varies considerably, according to the situation. In some cases it was found

to be ranging from 5 ore to 10 ore per 100 lbs., and in one case it was 25 ore per 100 lbs. These charges, of course, include the taking back of the separated milk. At one typical creamery it was found that the price realised for butter worked out at an average of 1s. 0¾d. per lb., and the working expenses at 7.75 per cent. on the total turnover.

Electricity plays an important part in Denmark, a telephone installation in Jutland costing only £2 15s. per annum, and in the islands £3 5s. Nearly every creamery has its telephone system, and indeed it may be said that every large farmer and tradesman of any consequence has a telephone service, and the telegraph service is thus little used. Creamery managers are thus kept in constant touch, not only with each other, but with the official experts in Copenhagen. In this way the latest advices as to market fluctuations and other matters affecting them are at once known. There is no such thing in Denmark as that of one creamery underselling another, but rather there is a general understanding to assist each other in raising the standard of quality and of price. In consequence of receiving regular monthly payments for their agricultural products, the Danish farmers seldom owe any debts to merchants, for they in turn settle their accounts monthly, thus securing to themselves a position of independence, which has added materially to their efficiency as agriculturists, and their social status as citizens. For much of this information we are indebted to the admirable report published by the Scottish Agricultural Commission of 1904 entitled "Farming in Denmark."

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Locust Destruction in the Orange River Colony and Basutoland.

Next to the Transvaal, the O.R.C. and Basutoland have done more active work in connection with locust destruction than any other South African Colony. It is not usual for locusts to lay eggs in large numbers in Basutoland, but this year large numbers crossed over from the Orange River Colony into the Mafeking district. The Resident Magistrate took prompt measures, and it is estimated that at least 80 per cent. of the voetgangers have been destroyed. The means employed in their destruction were sprays of soap while the voetgangers were small, and when larger the arsenical solution, which is employed in the Transvaal. The expenses of this work were £1,750. It is to be regretted, however, that the natives, with one or two exceptions, did not take more interest in the work.

The infestation of the Orange River Colony was very bad. At the beginning of the work public opinion was very much against locust destruction, and the appropriation for the work was very small. Furthermore, the supply of poison proved altogether inadequate; however, owing to the energetic and thorough work of the chief locust officer of that Colony public opinion was changed and good work done. The exact number of swarms destroyed has not been reported, owing to the lack of any system to collect data, but it amounts to a good big

percentage of the whole infestation. The total cost of the work has been £6,271 6s. 0d.

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The Orange River Colony is making preparations for a more extended and thorough campaign during the coming season. If the work is done as well as it was this year we may expect to see the locusts practically wiped out of the Orange River Colony. Both the O.R.C. and Basutoland adopted a system not used in other parts of South Africa, *i.e.*, the paying of bonuses for bags of locusts collected by the farmers. While this has given fairly good results it is not to be recommended. As the chief locust officer of the O.R.C. himself says, this bonus system is wrong in principle, and other methods of destruction give better and more thorough results. The cost alone is a great drawback. Basutoland paid over £650 for 7,693 bags of locusts, while the Orange River Colony has paid out over £5,000 for this purpose. Although this £5,000 means the destruction of 50,000 muid bags of locusts, amounting to 3,300 tons in weight, the same number could have been destroyed for a fifth of that sum, or less, with the arsenical spray. As an auxiliary method it helps to some extent, but is not to be recommended, unless some means can be found for making use of these bagged locusts, and thus derive a revenue from them.

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It is very encouraging to see our sister Colonies taking up locust destruction so heartily, after the strenuous efforts made by the late Mr. Simpson to interest the rest of South Africa, and make an effort to wipe out this pest from the country. Mr. Simpson lost no opportunity of presenting the need of locust destruction to the other Colonies, with the result that considerable interest is now being taken in the work, not only by the British territories, but even by the Portuguese Government. One indication of this interest is the formation of the Inter-Colonial Locust Bureau, organised at the instigation of Mr. Simpson, which is not only keeping the Colonies informed of the movements of locusts, but is also endeavouring to aid these Colonies in securing material, etc., for locust destruction at the cheapest rates.

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The Boring Branch of the Irrigation Department.

For some time past the Irrigation Department has been boring for water all over the Colony on most advantageous terms; but since some of our farmers are not aware of what has been accomplished by this branch we have pleasure in reviewing the progress made.

During the past financial year July 1st, 1905—June 30th, 1906, 51 holes, aggregating 4,297 feet in depth, have been drilled for farmers. Of these 10 were suspended until more suitable drills were available, and 11 were abandoned at a small depth for various reasons; the remaining 30 have yielded an estimated daily supply of 515,000

gallons. During the quarter ending 31st December, 1906, drills have been working for 17 farmers; 15 holes have been completed and six commenced; and a daily supply of 106,000 gallons has been obtained. During the six months ending 31st December, 1906, 200 feet more were drilled for farmers than during the whole of the previous year; it thus seems evident that the efforts of the Department in this direction are being appreciated.

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As the conditions under which boring is carried out for farmers do not appear to be generally understood, the following explanation of them is given. The Department has 18 drills, of various descriptions of the most modern and powerful types, which are allotted to applicants in the order of the date of their applications. As the cost of boring has lately been reduced, sanction has been obtained to reducing the rates for boring from the 1st March, 1907, and the reduction will amount to fully 20 per cent. on the charges hitherto enforced. Applicants are now required to pay £1 (instead of £1 2s.) per day after the drill has arrived at their farms during the time it is being off-loaded and erected, and, after erection, the sum of £2 (instead of £2 2s.) per day for each day the drill actually works. Charges are not made when the drill is stopped for repairs due to boring, or on account of the weather. Government will now provide, free of charge, skilled natives to work the drill (instead of unskilled natives furnished by the applicant as hitherto), and the first 20 feet of casing when that is required. The applicant has to provide any additional natives wanted to off-load and load the drilling plant.

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In addition, the applicant is required to provide animals to transport the drill from the nearest railway station, or the farm on which it was previously working, to his own farm, and to supply water and fuel for the drill. As a drill, on the average, bores about 5 feet a day, in the ordinary rocks met with, the average footage rate to the farmer is not high, and has worked out at the rates previously in force to about 7s. 6d. to 8s. per foot. With the rates now introduced the average cost will be about 20 per cent. less. The cost naturally varies with the quality of rock met with, as boring through hard rock costs very much more than that through soft rock. Taking the average results up to date, it is found that the farmer is called on to pay only about 1-3rd of the actual cost of sinking the bore, or, in other words, for every £1 paid by the farmer Government pays £2. With regard to the regulations, the only matters in which, apparently, changes are still desired are the reduction of the cost of boring and terms under which payment in full is required at the completion of a borehole.

In regard to the first of these, reference may be made to what has been stated above. The average charge to the farmer is only 1-3rd of the cost to Government; in addition he has to furnish transport from farm to farm, fuel and water. On the other hand, Government

also bear the whole cost of railway transport, and the whole charge of administration, which together exceed the amount defrayable by the farmer, in addition to the cost of drilling, for which accounts are rendered.

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On several occasions it has been proposed that payments for boring should be made by instalments, extending over 5 years, a system which is not in force in either of the Cape or Orange River Colonies. It is, no doubt, true that the conditions in those Colonies, where farmers are generally more well-to-do than they are here, are different from those that obtain in the Transvaal, and that the demand for immediate payment here prevents all but comparatively wealthy farmers from applying for drills. It has, however, been decided, for the present, that cash payments on completion of work shall continue, partly because there are more than sufficient applications to keep all the drills employed, and partly because the instalment system would involve considerable expenditure in administration which is foreign to the duties of an Engineering Department, and with which other Departments have not the administrative machinery to deal. It is hoped, however, if Land Banks are established, that they will grant loans to farmers for boring, and thus meet their wishes in this respect.

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A Land Bank.

Our readers will remember that Mr. J. A. Neser, M.L.A., contributed an able article on the subject of Agricultural Banks in "Journal" No. 15, Vol. IV., April, 1906. More recently Mr. Neser spent some time studying these and similar institutions in Ireland, and we are glad to be able to give a brief summary of his views on this matter :

"A Land Bank, I understand, to be a financial institution which lends or advances money under security of fixed or landed property, and if such definition be correct, I do not think that there is so much need for a Land Bank as for Farmers' Banks, Agricultural Banks or Credit Societies, which have for their object the financing of the poorer class of farmers and agriculturists. The Post Office Savings Bank and the Guardians' Fund, controlled by the Master of the Supreme Court, and a Government Commission, supply to a very considerable extent the needs for which a Land Bank would exist, and if those were properly administered, there would not be a crying need for the immediate establishment of a Land Bank.

"But there is, in my opinion, the greatest possible necessity for Agricultural Banks, Farmers' Banks or Credit Societies, which should have for their object the financing of the smaller men who have no land to mortgage and, consequently, not the security which would be required by a Land Bank ; and, instead of having one central institution, there should be a considerable number of them spread all over the country. These Credit Societies should be in the nature of Friendly Societies which have not for their object the making of gain

or profit, however small it might be, but purely and simply to render assistance to the members of the society. They should not be controlled by Government in any shape or form, save and except where Government lends money to any such society, or, in so far as it may be necessary to have Government control and inspection of the accounts of all duly registered and acknowledged Friendly Societies. I am convinced that, if such Credit Societies are once established, they could get sufficient money to lend to members either from capitalists who would not care about lending to individuals, also from the ordinary commercial banks as well as by way of deposit from members of the society, and others living in the districts where they operate. All that may be necessary for the Government to do would be to give a fair start to a few such Credit Societies, say, half-a-dozen at the outside, in properly selected and fairly populous centres. My objections to Government interference and Government control are :—

"1. That, as a general rule, the transaction of business through or with any Government Department involves a great deal of delay and expense which can, and should, be avoided when any small sums of money are needed ; and I would not advise that the Credit Societies suggested by me should advance more than about £50 to any one of its members

"2. When people borrow from Government they very often fall under the impression that there is no necessity for meeting their obligations when they mature, thinking always that it is the duty of the Government to give time and extend their credit.

"3. No matter what the constitution of the board might be, there is, as a rule, more sympathy with the private individual than with the Government, so that the security which would be offered and taken might, in many cases, be inadequate for the advances made.

"4. I am afraid that a lending institution, whether it be called a Land Bank, Agricultural Bank, Farmers' Bank, or Credit Society, if controlled by Government might be used by any party in power as a machine for securing votes and support.

"5. Above all things it is desirable to teach the people of this country to be independent and self-reliant, instead of always looking to Government for assistance.

"Now, Credit Societies or Farmers' Banks, as suggested by me, are unknown in this country, and, therefore, they may be looked upon with suspicion ; therefore, I say again, that the Government should give a few of such societies a start so as to satisfy the people with money that they can be, and are, safely and carefully conducted. Then there will be quite sufficient support.

"The way in which Government should assist, should be by way of loan to the society and not to any individual.

"Recently, on my visit to Ireland, I found out that the British Government does assist Irish Credit Societies in that way. When any society needs money, it makes an application to the Government,

mostly through the Irish Agricultural Organisation, and upon inquiry made as to the amount of money needed for any district in which the society operates and as to the sufficiency of the security of the members a loan is made to the society. The Credit Society is controlled entirely by a board or committee elected by the members of the society, and, as a rule, they are restricted to a particular district so that each man should know every other man. At the annual meeting, or special meeting called for the purpose, the committee is authorised to borrow a certain specified sum upon the credit of the members jointly and severally. When any member needs a loan, he makes application to the secretary, such application stating clearly the object and period for which the loan is required, and it is to be signed by two other members, who state upon the application form that they know that the intending borrower needs the money, and the object for which he needs it, and that they are agreeable to bind themselves as sureties and co-principal debtors for the loan. The committee then investigates the application, and either grants it upon the terms desired, or makes such other conditions as they may think fit, granting sometimes longer time than the applicant states that he would need, and sometimes giving a shorter time ; the object in view being generally to assist the man in such a way that he could have some return on his investment before being called upon to repay. Extensions of time are, as a general rule, refused, but they are granted sometimes under very exceptional circumstances of loss or hardship.

"In Ireland, the Irish Agricultural Organisation is charged by Government with the duty of inspecting and controlling Credit Societies, and I was informed that the greatest trouble they experienced is in respect of extensions of time for payment ; and their experience is that when people have received extension of time for one or two periods, they think that they are entitled to keep the money for good upon simple payment of interest.

"In this part of the country I find that the poorer class of agriculturists are obliged to sell their farm produce as soon as ever it is ready for sale, which is generally when the market is glutted and when prices are ridiculously low. If Credit Societies did exist, they could, in such cases, render very material assistance to struggling men by making advances for short periods so as to enable people to hold over their crops for a better market. The establishment of Credit Societies would go a long way to teach people the value of co-operation, and I feel sure that they will be followed by other co-operative societies, such as societies for disposing of their crops, societies for purchasing at wholesale prices farming implements, seeds, manures, etc. All the world over the small man is kept down by sheer force of circumstances. Lack of capital compels him to sell in any market His small crop of produce militates against his entering into any remunerative contract, and he goes on struggling from hand to mouth all through life. If anything could be done to teach our farmers co-operation, a great step in advance towards the betterment of their condition would be made."

The Standerton Stud Farm.

Plate Nos. CCV., CCVI., and CCVII. show views taken on the Government Stud Farm. As most of our readers are aware this farm was started with the object of improving the breed of horses in the Transvaal, as a large percentage of the native mares in this country are under-sized and very deficient in bone.

It consists of 8,000 acres of ground divided into paddocks of 1,000 acres each. There are at present on the farm 24 stallions, 15 of which are English thoroughbreds, 7 Australian thoroughbreds, 1 Yorkshire coaching horse, and 1 Basuto.

During the present season, 14 of these horses have been leased out to farmers in various districts in the Transvaal at prices ranging from £30 to £50 for the season. The remainder of the horses are kept at stud on the farm to suit the convenience of owners possessing a small number of mares, not sufficient to justify them hiring a stallion, but who may be anxious to send these animals for breeding purposes. Last season 130 mares were served on the farm, and during the present season, which is less than half through, 80 mares have already arrived for service. There are also belonging to the farm 72 mares; of these 18 are English thoroughbreds, and the remainder are a mixed lot of Colonial and American mares.

Although this farm has been but a comparatively short time in existence there is an undoubted improvement taking place in the class of stock exhibited at the shows held in districts where these horses have been standing at stud. During the year eight specially selected Catalonian jack donkeys have been imported for mule breeding, the object being to enable farmers to get an adequate return from mares, from which, owing to some hereditary unsoundness, it would be inadvisable to use for horse breeding, and at the same time to breed a good class of mule, as this animal has been found to be most useful in this country. There are also on the farm a few pigs of the following breeds :—Yorkshire, Tamworth and Large Blacks; besides which 46 Texan cows have done very well and 50 head of yearlings; and at the date of writing the 21 young calves, from a Shorthorn bull, are most promising; while 37 Angora ewes and 2 Angora rams and 31 kids complete the list.

* * * *

500 acres of land are under cultivation on the farm. With a view to lessening the cost of feeding the stock, as well as for experimental purposes, the following crops were put in during the past season :—100 acres of mealies, 60 acres of oats, 50 of manna, 20 of mangels, 20 of lucerne, 2 of cabbage, 1 of carrots, 1 of kohl rabi, and 1 of swedes, 15 acres of Teff grass, 5 acres of experimental plots; also 5 acres of mixed mealies and soy beans for ensilage, 3 acres of sugar beets, 8 acres of mealies for stover or mealies cut green and dried for feeding. The success of those various crops is undoubtedly due to the painstaking preparation of the land resulting in a fine mellow seed bed.

At the time of our visit the dry land lucerne, which was planted on November 22nd, was looking most promising. This had been planted in rows 20 inches apart. The success of this crop is largely attributable to its having been sown in drills and to the land being well cultivated. The seed used was Provence and Hardy varieties (Plate CCVI.). The six acres of New Zealand oats were planted on the 5th of November, grown from "B" Garton seed.

* * * *

All the mealies have been put in with the check row planter, and the results have clearly demonstrated the cultural advantage of this system. The photograph shows the growth of the Early Leaming at the middle of January, planted 26th October. (Plate CCVII.) There was also an experimental field of 24 different varieties of Whites and Yellows.

A word as to the mangel. The land was dressed first with bone dust, about 4 cwt. to the acre; and later the growing mangels were treated with a top dressing of nitrate of soda and salt at the rate of 7 stone per acre nitrate of soda and 2 cwt. of salt—the benefit of this application is clearly apparent from the vigorous growth made by the roots as shown in the photograph. Last year 160 tons of hay were put up on the farm, and proved a valuable stand by owing to the shortage of last season's forage crop from drought. An experimental arboretum of 40 acres, under the charge of the Conservator of Forests is now in course of formation on the farm. It is hoped that this will be of great value in furnishing reliable data respecting the variety of trees likely to do best on the High Veld—a matter about which very little is known at present.

* * * *

Mr. McNae, the acting manager, emphasises the importance of feeding and sheltering stock during the winter months. This applies more particularly to young stock, as should these precautions be neglected they are apt to be stunted in growth. This does not mean stabling during the day-time, but simply cover during the cold nights with a suitable ration night and morning. This ration should, if possible, consist of crushed oats mixed with crushed mealies; together with oat hay or manna. Where oats are not obtainable a good ration of crushed mealies and hay forage has been found to answer well. During last winter the ration for the Government mares consisted of 7 lbs. of mealie cob meal to each animal. This cob meal was made by simply taking the cob with the seed on it and putting it through a crusher.

During the breeding season stallions ought to get a liberal allowance of the best feeding to keep them hard and maintain them in good condition. On the Stud Farm none of the Government mares are served after the 31st January, the aim being to have all the foaling over by the end of December, while there is still good grass, so that during the first few months of the foal's existence the mare may have an ample supply of green grass, and so be better able to nourish the foal.

We are indebted to Mr. R. T. A. Innes, Director of Meteorology, for a few timely notes on the recent great rainstorms and two interesting plates (Nos. CCIII. and CCIV.)

Rainfall.

The present rainfall season has been a copious one, but it does not make a record. Each month, from October to January, has had good rains, generally well over the average season in amount. Very few of the rains have been the short sharp showers due to thunderstorms, which make up the greater part of the High Veld rainfall in most seasons. This season has been remarkable for the persistency of its cold north-easterly or easterly rain-bearing winds. Thus the rains, whilst wetting the ground thoroughly, have not been very useful in filling dams and reservoirs, for which purpose a heavy thundershower is often more effective.

* * * *

The very heavy rains which occurred early in February, although of the north-easterly type, falling as they did on ground already thoroughly soaked, provided the needed "run-off" of water to fill dams to overflowing, and to bring the rivers up to their banks. The first two days of the month were marked by passing showers, but on the 3rd heavy rain commenced, and continued more or less until the 6th. On the 6th and the 7th, rains were still general in the eastern portion of the Colony, but were evidently finishing. These easterly rains are invariably heaviest over the Drakensberg and the seaward slope of that range, and diminish as the western border is approached. Some places in the east had over 12 inches, but the 6 inch line was fairly well marked, running through Leydsdorp and Mbabane. The Klerksdorp-Potchefstroom district had a heavier fall than most places on the High Veld, whilst in the south-west the rainfall diminished to a paltry ½ inch. The rainfall over the Sprinbok Flats and up to Pietersburg was light. Averaging over the whole Colony, the rainfall in these few days (say three days during the seven) amounted to about 5 inches. The slope of the country is such that the surplus water of the more favoured regions (Ermelo, Standerton, etc.) is carried down to those parts where the rainfall was scanty, by means of the Vaal River. This suggests in a marked manner that if the farmers of this country desire the benefits of irrigation for their lands, nature has already done its share of the work, and that it only remains for man to turn to use its bountiful store.

* * * *

Five inches of rainfall over the Transvaal, with an area of 115,000 square miles, means an amount of work done by the sun compared with which the efforts of man seem insignificant. It means that the sun has raised from the surface of the ocean (in this case probably the Indian Ocean), carried to the land and then deposited some 45,000,000,000 tons of water. At their present rate of production the gold mines of the Transvaal would haul this amount of ore in 90,000

Plate CCV

Mangels.

Government Stud Farm, Standerton

Plate CCVII.

A Field of Maize.

(Early Leaming Mealies.)

Government Stud Farm, Standerton.

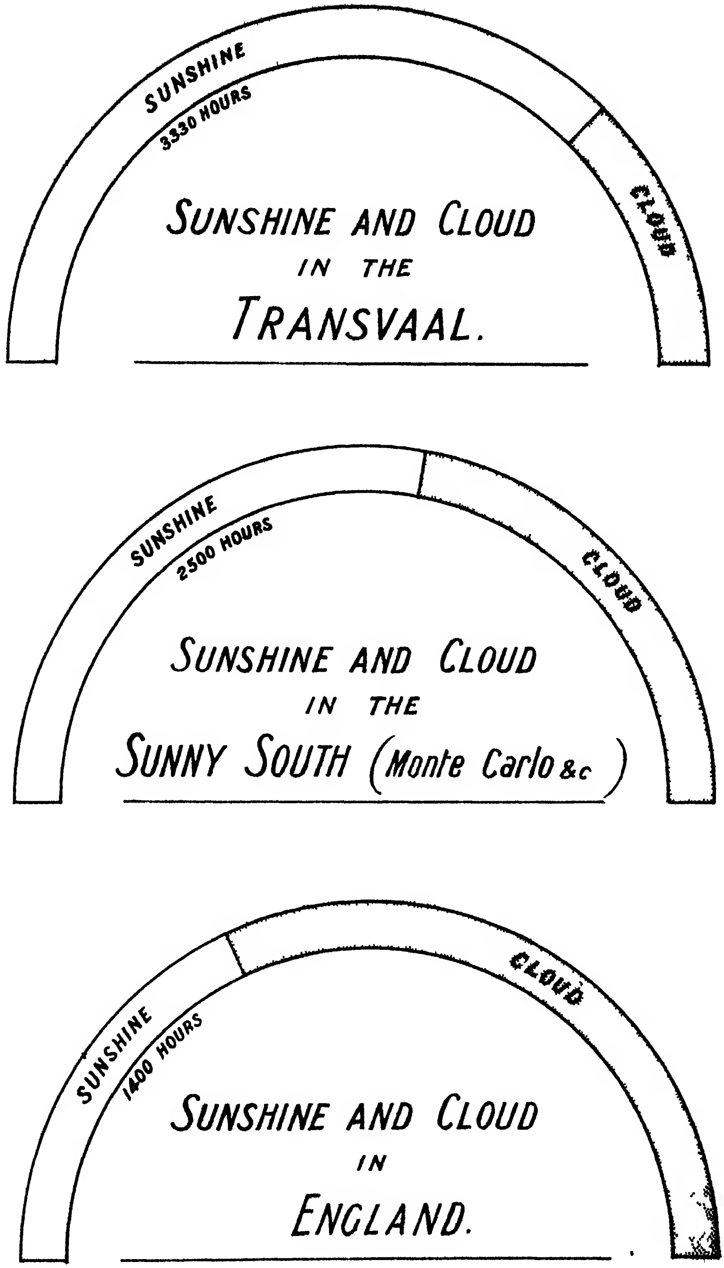
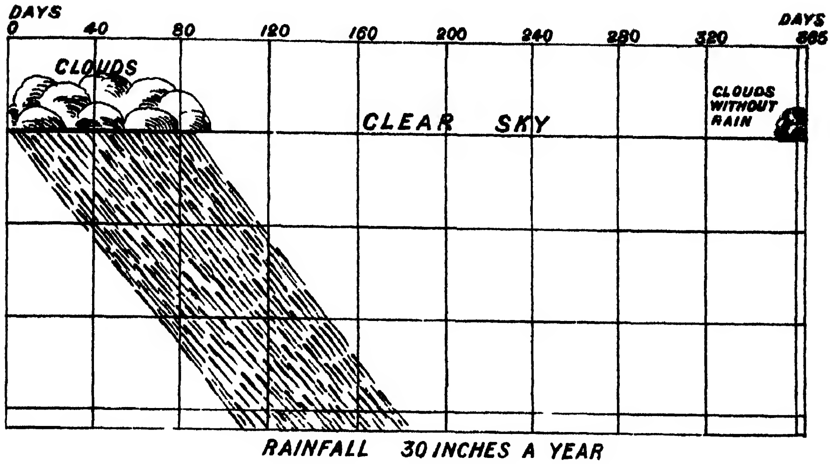


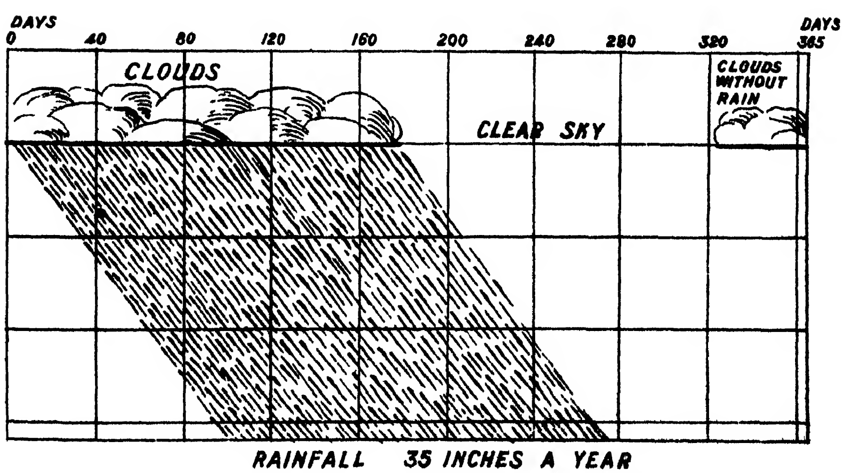
Plate CCIII.

The Climates of three Countries.

AVERAGE RAINFALL



TRANSVAAL.



ENGLAND.

Plate CCIV.

A Comparison of Rainfall.

Plate CCVIII.

Kaffir Cows.

The old breed of the country

Showing a two year old Somali Cow and a four months old Calf from a Devon Bull.

years. It is not well to pay too much attention to this method of presenting statistical information. If, however, the big figures arrest our attention for a moment, and make us ask the question "Do we turn Nature's easy efforts, so prodigal in amount, to the best purpose?" they may have some value.

It is thus clear that our rainfall, variable as it may be, and in spite of our long dry season, is more than ample in amount. And the limit to the conservation of water in the Transvaal is plainly a human limit. We mean that the water is here; but the engineering works are not. And to turn our natural and copious water supply to the best use will call for not only the art of the irrigation engineer, but also the industry of the dry land farmer, and finally the financial aid of the Government.

These remarks have been prompted by the recent great rainstorm. For the next few months the country will be gradually draining into our great river systems, which will be running strong. Later, during our long dry season, the country will become parched and the water offered us by Nature for conservation will have returned to the ocean, and so be no longer available for our needs.

* * * *

Cattle at Jamesville.

Our readers will be interested in Plates Nos. CCVIII. and CCIX., which represent in the one case a Somali cow and calf, and in the other two Kaffir cows. These animals belong to Mr. R. T. N. James, of Pretoria, who is actively engaged in grading up a mixed herd. His favourite breeds are the Ayrshire and Friesland. He has been buying calves from good milk stock and rearing them for milch cows, instead of passing them over to the butcher as is the common practice of town dairymen. Mr. James is also crossing the Ayrshire and the Africander in the hope of combining the milking strain of the former with the hardy nature of the latter.

* * * *

Agricultural Shows.

Klerksdorp	.. ..	17th April.
Johannesburg..	..	1st to 3rd May.
Pretoria	.. ..	About the end of May.

We would call attention to the forthcoming Klerksdorp Agricultural Show. Over £5,000 have been spent on the grounds and buildings, the latter, which comprise stall accommodation under cover for 250 entries in horses, cattle and small stock, besides poultry, machinery and produce sheds. The Agricultural Hall and Grand Stand were erected by public subscription at a cost of £600 in honour of the Diamond Jubilee of H.M. Queen Victoria. Klerksdorp may well claim to have a model show-yard, and we are sure our readers will show their appreciation of the Committee's spirited enterprise by turning up in large numbers.

Illustrations.

Plate No. CCXI. is a gratifying indication of the progress of the campaign against cattle disease. On account of an outbreak of East Coast fever quarantine restrictions were imposed on the Pretoria Town and Town Lands under Government Notice 301, dated 3rd March, 1904. These restrictions were raised on the 20th December, 1906, after a period of two years and nine months. It is always a pleasure to point to the enterprise of our sheep-breeders, and we have pleasure in publishing Plate No. CCX. showing *His Majesty*, a 4-tooth ram, which took first prize at the Port Elizabeth show; this animal was bred by Mr. F. W. Southey, Hillmoor; and *Gambler*, bought at the Melbourne sales by Mr. J. W. McCarthy. Both animals are owned by Messrs. A. and V. Robertson, and are now at Macquabi. For the cover plate, showing a span of Zebras, we are indebted to Mr. H. Exton, of Pietersburg, as well as for the picture of the Arum Lily which we reproduce on Plate No. CCXII.

"His Majesty."

1st Prize Port Elizabeth Show owned by Messrs A & V. Robertson, Maquabie, Wakkerstroom

Plate CCX **"Gambler."**

A Tasmanian Ram owned by Messrs. A & V Robertson, Maquabie, Wakkerstroom

‘o CCXI

A Morning Scene on the Market Square of the Capital.

Plate CCXII. [*Photo by H. Erton, Pietersb*

The Arum Lily.

Growing wild in the Zoutpansberg

CORRESPONDENCE.

This column will be devoted to correspondence, and an endeavour made to reply to all inquiries upon agricultural topics, or concerning any of the articles published from time to time in the *Journal.*

Correspondents will kindly write on one side of the paper only. No manuscript will be returned.

All letters must be addressed to the Editor of the "Agricultural Journal," Department of Agriculture, Pretoria.

BEES AS FERTILISERS OF FRUIT BLOSSOMS.

To the Editor of the Agricultural Journal.

Sir,—It has frequently happened that bee-keepers and fruit-growers have come into conflict owing to the latter stating that bees injured their fruit, in consequence of which they have had them removed on the grounds of being a nuisance.

At the time, fruit growers were not aware that they were removing the very insects which were most necessary for the fretilisation of their fruit blossom, and thereby producing an abundant crop of fruit which would otherwise have failed to come to fruitage, so that they were benefiting considerably more than the bee-keepers themselves. So the bees were really a blessing instead of a curse.

It is an erroneous idea to suppose that bees damage fruit by piercing it, and the real culprits you will find are birds, wasps, beetles, grubs, and, sometimes, an abundance of rain causes fruit to swell and burst. When the havoc has been done and the juices trickle from the fruit the bees come to the rescue and gather the juices, giving a supply of honey which would otherwise be lost were they not present.

It has been ascertained that, after the removal of bees for several seasons, fruit crops almost entirely failed although the trees were laden with blossom, and when the hives were replaced, abundant crops followed, which shows that fertilisation was absolutely necessary.

This testimony proves most conclusively that the two industries go hand in hand, each being dependant on the other.

In further proof of this statement, I would refer to such an authority as Professor A. J. Cook, at one time Entomologist at the Michigan Agricultural College, who says that, although there are solitary insects that help to do the pollen scattering, the work they perform is infinitesimal as compared with that of bees, because, unlike the bees that live over winter, they are not present in early spring when the fruit trees are in bloom.

Numerous experiments have been tried on various fruit trees by surrounding some unopened blossoms with cheese-cloth, and kept covered till the bloom fell off, and others left uncovered, and, without exception, the uncovered bloom gave a very much larger percentage of fruit.

Mr. Frank Benton, of the Department of Agriculture, Washington, says, for several years the cherry crop of Vaca Valley has not been good, although it was, formerly, quite sure.

It was then discovered that the lack of fruit was owing to wild bees having disappeared, and, to test the matter, several hives of bees were placed in an orchard, with the result that good crops of cherries were produced, whilst other growers in the same valley five miles away who had no bees only produced light crops.

Several years ago a convention of fruit growers and bee-keepers in the State of Michigan assembled together for the purpose of discussing their common interests, and the fruit men acknowledged generally that bee-keeping in the vicinity of their orchards was an important factor in the production of fruit. It was proved beyond doubt that they not only secured abundant crops but more perfect fruit.

To ensure success in fruit growing it is necessary to keep bees. Besides, an apiary in or near an orchard would be a decided advantage to the fruit grower from a remunerative point of view if conducted in a practical manner: that is, by using modern bar frame hives and all the latest appliances for successful bee culture. The late Mr. C. B. Simpson, Government Entomologist, was a bee enthusiast, having imported several colonies of Italian bees, and strongly advocated bee-farming in connection with other pursuits.

For the information of farmers, honey in 1 lb. sections is retailed at 2s. to 2s. 6d.; shallow frames, 5s.; deep frames, 7s. 6d.; liquid honey in bottles, 2s. to 2s. 6d.; which prices should prove a remunerative business to those having thirty or forty colonies of bees.

In the United States, laws are enacted prohibiting the spraying of trees with poisonous mixtures during the blossoming season, and this operation does not take place until the fall of the flower. Of course, in many instances, the law is ignored or contravened by fruit-growers who are unaware of the immense value bees are. This law was passed to prevent the destruction of bees so as to enable them to continue their work of fertilisation, and, at the same time, to prevent honey being poisoned.

It might not be out of place here to mention what a valuable asset bees are to some countries where enormous quantities of honey are produced. Take Germany, for instance, with 2,000,000 bee hives producing 20,000 tons of honey, and Spain, with 1,690,000, furnishing 19,000 tons: these two countries producing nearly half the World's supply.

South Africa with its enormous expanse of country, and climate better suited for bees than colder countries, containing a variety of bee forage in the shape of nectar-producing trees and flowers, besides grasses and various plants, might well become a large exporter of good wholesome honey.

Yours, etc.,

Pretoria. D. CAIRNCROSS.

DRIED LOCUSTS FOR POULTRY.

To the Government Entomologist, Pretoria.

Sir,—During the past six months I have made a careful experimental trial of feeding locusts to my poultry from the six bags you sent to me last July. I commenced by feeding two breeding pens and fifteen chickens four weeks old, first weighing all the birds, and also weighing an equal number of birds that received no rations of locusts at all. All the birds were prize birds or their strain, and all the stock received exactly the same ration of the ordinary diet, only those selected receiving the locust diet extra. I made a start with the breeding pens, giving 2 ounces to each bird per week. On the second week I increased this to 2½ ounces per week, and on the fourth to 3 ounces. To the chickens I gave one ounce per week, increasing the ration on the second week to 1½ ounces, and on the fourth to 2 ounces.

On weighing the birds, those in the breedings pens had increased in weight on an average of four ounces per bird, some birds weighing as much as 7 ounces over those that received no locust ration. The chickens had gained an average of 4 ounces per bird, while several scaled as much as 6 ounces over those receiving no locust ration.

I then increased the ration of the chickens to 2½ ounces in the sixth week, and to 3 ounces in the eighth week. The breeding pens I kept on the 3 ounce ration. At the end of the eighth week, I again weighed the birds, when it was found that some of them scaled as much as 9 ounces per bird more than those which received no locust ration. All the birds maintained a strong and healthy condition. During the second month the breeding pen only increased slightly in weight, but the supply of eggs was greater and they were much larger. The quality was also considerably improved, the yolks being of a richer colour than those which were fed on the ordinary diet. I found, however, on boiling an egg that it had a peculiar strong smell, and tasted peculiarly. This led me to try and ascertain whether this peculiarity was due to the locust feed. I picked out a few common pullets and gradually increased the ration of locusts to 6 ounces per week to each bird, when I found that the yolks were almost red and the smell and flavour was very strong. On killing one of these pullets I found that she was very fat, but the liver was considerably enlarged. When roasted, a very strong flavour, quite different from the ordinary fowl flavour was noticeable.

At this stage I stopped all locust diet for a week so as to give the birds a rest, after which I again put them to locust diet, and after close observation I ultimately arrived at what I consider the proportions in which locusts should be fed to fowls so that the best results may be attained.

I strongly recommend this ration to all poultry-keepers for the following reasons:—

The fertility of the eggs is considerably increased, an average of 90 per cent. of strong chickens hatching out from the eggs of birds

fed on the locust ration, and the percentage of protein and fat appears to be very high, which, in my opinion, is one of the most important factors in successful poultry rearing.

Scale of quantities:—

(*a*) Breeding pens, 3 ounces each bird per week.

(*b*) Laying hens—to supply eggs for table—2 ounces per bird per week.

(*c*) Young stock—

Chickens	from	4	days old,	½ oz.	each	per	week.
"	"	3	weeks "	1 "	"	"	"
"	"	4	" "	1½ "	"	"	"
"	"	6	" "	2 "	"	"	"
"	"	10	" "	2½ "	"	"	"
"	"	16	" "	3 "	"	"	"

Locusts should be ground through an ordinary meat mincing machine and the ration prepared as follows:—Weigh out the quantity of locust required, and add one teaspoonful of table salt and a little pepper to every pound of locust. Mix well and pour boiling water on, then add sufficient bran or meal to make a stiff mash. Serve warm in a trough or on a board in the early morning. This ration to be fed only three times a week.

Birds receiving this diet require no meat and very little green food. Every eighth week the locust ration should be stopped for one week so as to give the birds a rest and change. They are very fond of the locust diet given as above described.

This season I have reared over 200 chickens, and although the season has been exceptionally wet, they are in perfect health and very strong for their age.

It will be seen from the foregoing that great care must be taken in feeding with locust ration so as to gain the best results, especially where egg production is aimed at, and also when birds are required for killing. In the latter case the locust ration should be stopped for about a month before killing, and the birds given a suitable meat ration instead.

It is my intention to make further experiments on a much larger scale, when I shall have pleasure in reporting the results to you.

Should any of the foregoing remarks be of interest to poultry breeders, you are at liberty to use this report in any way which you may deem necessary for the benefit of the poultry industry.

Yours, etc.,

Pietersburg. H. MOORE.

* * * *

BARREN AND BRAK SOILS.

To the Chief Chemist.

Sir,—With reference to your analysis of recent date, I beg to say that the soils in question have again proved disappointing in

patches, and I am in doubt whether to attribute this to an excess of soda salts (brak) or to an excess of water. Possibly on reference to your analysis you might be able to tell me whether you found salts in excess. If so do you think I should do well to manure with bi-sulphate of potash from the dynamite factory?

A few things puzzle me in this matter; where the stuff grows, it grows luxuriantly. It does that on all high patches (old dam walls, old ant heaps, etc.), and wherever it gets kraal manure. The crops die entirely in the low places. The irrigation water is carried off by surface drains. The worst places seem to be those showing white lime.

Your valuable advice will be greatly esteemed. If no suitable neutralizer can be suggested for the assumed excess of salts, what crops should the land be used for? Would lucerne do?

Yours, etc.
S. L. KLING.

Answer: I received your letter of recent date respecting the barren character of certain areas of the land, samples of the soil of which we examined.

As you will see, the sterility could hardly be due to lack of plant food, but might be caused by brackishness. I have had your previous samples examined with a view to detecting whether there is any evidence for this.

We find that sample labelled S.W. contained mere traces of chlorides and sulphates, but that considerable quantities of soluble chlorides (probably common salt) were present in samples S.E., N.E. and N.W., while samples N.W. and S.E. also contained a distinct quantity of sulphates.

The figures are as follow :—

Extracted by water from 100 parts by weight of soil.

	N.W.	S.W.	N.E.	S.E.
Chlorine	0.083	none	trace	0.034
Sulphuric acid ..	0.027	trace	0.032	0.041

These quantities were obtained from portions of the whole samples you sent. I have no doubt that in portions quite near the surface the proportions are much higher.

I shall be interested to know whether N.W. and S.E. show more of the bare patches than S.W. and N.E.

As to remedies, since the harm apparently results from chlorides and sulphates, for none of the soils were alkaline (*i.e.*, none contained carbonate of soda), I fear that no application will be of any use. I think that bisulphate of potash would probably do more harm than good.

I believe the only plan will be to irrigate seldom, but very heavily, so as to wash the salts down into the subsoil. The best way, though

perhaps too expensive, would be to put in subsoil drains. Is your irrigation water brackish?

As to suitable crops, mangels, cabbages and beets would probably be able to stand as well as any ordinary crops, and would be suitable if you can make use of them. I fear lucerne would not do well, for though it can resist alkalies fairly well when once established, it is, when young, very susceptible to them.

Trusting you will be able to overcome your difficulties.

Yours, etc.,
HERBERT INGLE,
Chief Chemist.

Sir,—Please accept my thanks for your exhaustive reply to my enquiry. I hasten to give you a few details not previously mentioned :

1. I picked all the worst patches I could find, selecting especially those showing salt efflorescence.
2. S.W. is the best place.
   S.E. the worst.
   N.W. is good (relatively).
   N.E. bad.
3. All the samples were taken from surface.
4. The irrigation water is from the Mooi River and, though hard, is not considered brak.
5. These patches are said to have been successfully overcome in my district by dressing with powdered ant heap ; is this likely? I do not know if they contain any appreciable quantity of formic acid, though I know they contain secretions.

Others recommend wood-ash ; do you think this good?

Would Australian Salt Bush do on these soils, and would it improve them, or do you think Sunflowers, Lupins or Sainfoin likely to succeed?

Thanking you for your valued assistance.

Yours, etc.,
S. L. KLING.

Answer : I am in receipt of your letter regarding "Brak Soils," and note that the composition of the soils agrees with practical experience as indicating that S.W. is the best of the four samples, and S.E. the worst. On the other hand, you say that N.W. is relatively good, though our figures show it to be worst in chlorides, though not so bad in sulphates.

With reference to your suggestions as to powdered ant-heaps and wood-ashes, you will find in the "Agricultural Journal" (Vol. III. (1905), pp. 533 and 729) analyses of ant-heaps as compared with neighbouring veld soil, and some information as to their manurial value. As sources of plant food, they are undoubtedly of considerable

value, but I have doubts as to their possessing much value for correcting a "brak" condition of the soil. Your land is apparently fairly well supplied with plant food, and your great trouble is to overcome the effect of the too-abundant chlorides and sulphates not to enrich your soil with plant food.

However, both ant-heap and wood-ashes would tend to improve fertility even if only by way of diluting the brak soil. I still think your best plan would be to attempt to leach out the saline matter by heavy irrigation at long intervals, especially after rain, and to grow such crops as are tolerant of "brak." Stirring of the surface soil to a depth of 4 or 5 inches so as to form a mulch at frequent intervals could tend to prevent the rise of saline matter from below, and would mitigate the evil.

As I have already said, mangels, cabbages, beets and, of course, salt bushes would probably be the best crops, and their growth might certainly be expected to reduce the amount of common salt and sulphates in the soil.

HERBERT INGLE,
Chief Chemist.

Dr. Hilgard, of California, mentioned to the writer that in cases where the alkali (brak) soil was found to be concentrated near the surface removing the top 6 to 8 inches by means of an ordinary scraper had proved successful in Western America.—Editor, "Agricultural Journal."

* * * *

RAMIE.

To the Agrostologist and Botanist.

Sir,—I notice much is written about this fibre at present. Can you get me full particulars as to cultivation, etc., and likely soil to suit it? I am willing to try a ten acre plot if satisfied that it is a good thing. What about de-gumming, decortication and stripping, etc.?

Yours, etc.,
C. F. HEUGH.

Embabane, Swaziland.

Answer : I am in receipt of your enquiry on this subject, and have pleasure in giving you the following information :—

Ramie has been grown experimentally (1) at Skinner's Court Experiment Station ; (2) at the Government Estate, Tzaneen, Haenertsburg, Zoutpansberg ; (3) Piet Retief and (4) at one or two places in the Lydenburg District.

In each case it has done fairly well, and given satisfactory evidence that it can be grown in the Transvaal ; it is, however, only suited to the Middle and Low Velds. There are two varieties—the Silver Ramie (*Boehmeria nivea*) and the common Ramie, the former only, however, is suited to the climate of this country.

The commercial success of Ramie depends greatly on the facilities in preparing the fibre for the market. At present the process is very expensive and the machinery none too good. You will find an article on the cultivation, etc., of Ramie in the "Transvaal Agricultural Journal" for January, 1905.

We would strongly dissuade anyone from going in for this crop on any large scale until they have first tried it experimentally and found a market for their fibre when produced.

Many American planters lost large sums of money on this crop when it was so largely boomed a few years ago.

The best soil for growing Ramie is a rich loam, preferably of a light character, but richness is essential.

The decorticating machinery available is, as far as we know, still very far from being perfect for the purposes for which it is required.

J. BURTT-DAVY,
Agrostologist and Botanist.

* * * *

PEA NUTS.

To the Agrostologist and Botanist.

Sir,—I am anxious to plant a quantity of monkey nuts, and would like to know if you can supply me with seed, and at what price ; and, further, whether the country around Johannesburg is suitable for this culture, as well as any further information you may be good enough to supply.

Yours, etc.,
Johannesburg. T. M. CULLINAN.

Answer : Answering your letter of the 6th instant, we have pleasure in giving you the following information :

Pea-nuts (*Arachis hypogoea*) can be grown anywhere where mealies will ripen, but they are better suited to a lower elevation than Johannesburg ; however, we see no reason why they should not do satisfactorily with you if sown early enough. The plant takes about five months to mature, and so you should get your seed planted out as soon as possible. A sandy soil is necessary.

We can send you 10 lbs. for trial free under the usual co-operative experiment terms ; this is sufficient to sow about ¼ acre. We could probably sell you another 20 or 30 lbs. at 5½d. per lb. This is imported seed of the Virginian Mammoth Pea-nut.

For further particulars re planting, etc., I would refer you to the last issue of the "Transvaal Agricultural Journal," No. 17, Vol. V., p. 161. If you have not a copy you will receive one on application to the Government Printer, Pretoria.

Sowing is about 40 lbs. per acre.

J. BURTT-DAVY,
Agrostologist and Botanist.

Plate CCXIII

"Kapena"

Oldenburgian Cow (Herdbook No. [illegible]71) Breeder Bernhard Achgelis Esenshamm Germany

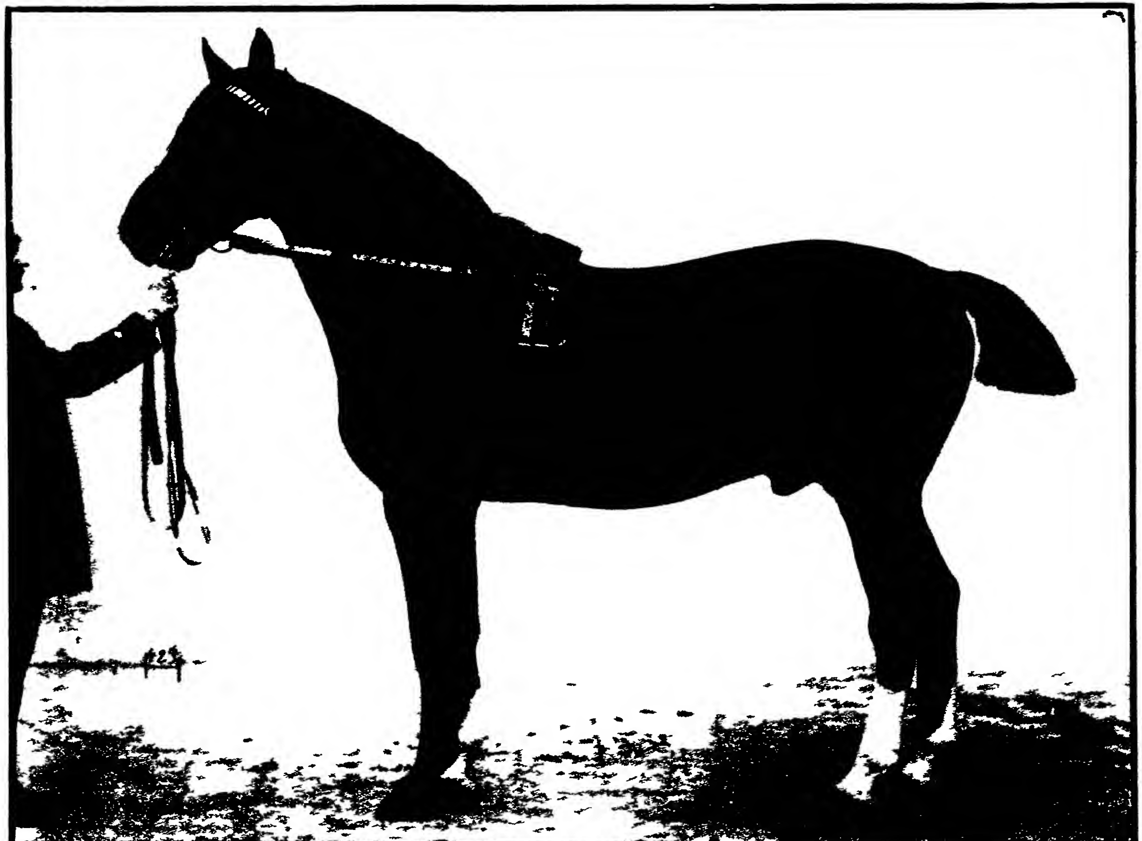


Plate CCXII **"Alnok."**

Hanoverian Stallion (Studbook No 53) Breeder Herm von Seht Otterndorf Hanover Germany

THE BREEDING OF DOMESTIC ANIMALS IN GERMANY.

To the Editor of the Agricultural Journal.

Sir,—During my visit to Pretoria you asked me to write a short account of the agricultural industry of Germany, and I have pleasure in sending you a few notes on the subject of special interest to me, namely, the breeding of domestic animals, which I trust may be of some use to the farmers of the Transvaal.

Favoured by a peace of 36 years, and owing to the rapid progress of the art of agriculture, as well as to the scientific education of the German farmer, the breeding of animals is now flourishing in Germany to a degree never dreamed of. And the prices of domestic animals have risen with the growth of the population and its prosperity. Twenty years ago the German workman had to put up with vegetables, bacon and salt-herrings on week days ; only on Sundays had he meat on his table ; but now he has fresh meat for his dinner every day, and ham or sausage for breakfast and supper. From a great agricultural State, Germany has now been transformed into an industrial nation. In the Western Provinces this change has been accomplished, but in the Eastern Provinces, where it is still in progress, the farmers are suffering from the scarcity of workmen and the gradual rise in their wage bill. However, the more intelligent of these farmers, by their skill in the breeding of horses, cattle and pigs have not only succeeded in making the two ends meet, but have even achieved a marked improvement in their situation. There is, however, not much breeding of sheep in Germany now-a-days owing to the enormous competition of Australia, South America and Africa.

In the marsh-land near the German Ocean, and in the Highlands of South Germany, the mountains of Bavaria, Wurtemberg and Baden, the inhabitants knew since centuries that breeding of animals must naturally be the most important part of their farming, for, owing to the quality of the soil to absorb water in great quantity and the dampness of the air, the most splendid grass is found in those parts of Germany. But the advancement of the science of agriculture in our time enables the farmers in the other German Provinces also to develop the breeding of animals more and more. To-day cattle are bred in consideration of colour, frame of body and descent. The quantity of the milk and the fat it contains is examined in comparison to the value of the food. Everywhere in the Empire the breeders of horses, cattle, and even of sheep and pigs have formed societies for the advancement of the science of breeding. The farmers themselves have founded more than four thousand dairy societies, and the profits of these dairies show that the work of the breeders had not been in vain.

In the marsh-lands of East Freisland, in Oldenberg, in the marshes of the Elbe and Holstein, horse-breeding is entirely in the hands of small farmers, and as it brings in a very fair profit these farmers are mostly wealthy. Strong cart-horses are commonly bred. How well this horse answers to the demands of the market is proved by the fact

that there are exported every year at least 100 stallions to North America, and that you will find in Holland, Groningerland and West Frezland more stallions from Oldenberg and East Frezland than in these countries themselves.

The cow of East Frezland is famous for the abundance of milk it gives. The value of the fat the milk contains is not high, but the farmers are eagerly trying to raise it. There are three different colours in which the East Frezland cattle are bred ; black and white, red and white and red. The full grown cow weighs from 900 to 1,700 lbs. The cows of medium weight give the most milk, about four thousand bottles in the year, but very often eight thousand bottles have been obtained. In East Frezland the cattle are driven out to the pastures in the beginning of spring, and remain there day and night until the beginning of winter. In consequence of this they are of a strong and healthy constitution.

The cattle in Oldenberg are in some respects equal to those of East Frezland. By means of the excellent quality of the soil in the marshes of the Weser, the cattle are bred to such weight as is not to be found in any other place in the world.

In the mountainous parts of South Germany the "Simmenthaler" cow is now mostly bred ; she is white and yellow. Her milk is more fat than that of the Frezland cow, but she gives less. As she is quickly fattened she is preferred to the Frezland cow in those countries where cattle are fed in the stables.

Breeding of sheep in Germany is of importance only in Saxony and in the Eastern Provinces. Here the merino is kept, and the highly developed sheep-breeding of Australia, South Africa and Argentina is founded on the German merino ; for the merinos of Germany are constantly and with great success exported to the countries for the renewal of blood. The breeding of the Rambouillets —originally a French sheep—is, since the middle of the last century, flourishing in Germany. The German Rambouillet is stronger than the French, and is in some countries preferred. In the Western Provinces of Germany a kind of milk-sheep is kept, but will be of little interest to South African farmers. Still to those breeders who want a quick multiplication of their flocks, it may be instructive to learn that this milk-sheep gives from 500 to 600 bottles of good milk. A rich pasture is, of course, essential, and where that is not to be had the sheep must be fed.

The German pig breeders import pigs from England for the renewal of the blood, so the breeder in South Africa should do the same. But it must be said in praise of the pigs of Westphalia and Hannover that they are more fertile and stronger than those of Yorkshire and Berkshire.

It is not long since German agriculture has been completely re-organised in the so-called "Landwirtschafts kammern" (Chambers of Agriculture). These chambers have a limited right of taxation. Each chamber works for one Province, so there is a separate chamber

for Westphalia, for Hanover, for Saxony, etc. All the Chambers of Agriculture have one central bureau in Berlin. By making use of these institutions the farmer of German South Africa is to a certain degree independent of the breeder in Germany. If he wishes information about the horse of Hannover, the pig of Westphalia, the merino of Saxony, or about the most important breeders of these animals, he simply addresses himself to the Chamber of Agriculture of Hannover, Westphalia or Saxony. Should he wish information about the whole subject of animal industry in Germany then he can get it through the central bureau of the Chambers of Agriculture in Berlin.

Yours, etc.,

Dr. WEGNER,

Secretary of the East Fresian Society of Agriculture.

Norden, Hannover.

* * * *

CO-OPERATIVE CREAMERIES.

To the Editor of the Agricultural Journal.

Sir,—With reference to our conversation a few days ago on the question of Co-Operative Creameries, I think that Farmers' Associations or other bodies contemplating the establishment of creameries for the benefit of farmers should also consider the question of laying themselves out to deal with the supply of poultry and eggs to the consuming centres.

This could not in any sense be termed outside the sphere of a creamery, and so far as the farmer is concerned he could deliver his fowls and eggs at the creamery along with his cream or milk. The creamery could be arranged with special freezing and chilling rooms in which to store the poultry and eggs in the season of plenty, and by this means maintain a constant and steady supply to the market all the year round.

At present the work of collecting poultry and eggs from the farmers is almost entirely in the hands of foreigners, and I think one would be quite safe in hazarding the opinion that they find it highly remunerative, and as the prices obtainable in Johannesburg and other consuming centres are controlled to some extent by imported poultry, it follows that the profit made by these small traders is earned entirely at the expense of the farmer, who should be in a position to place all his produce on the market through the medium of co-operative establishments in which he would be a shareholder.

I would not recommend co-operative establishments to attempt to run retail businesses in the towns, as this would bring them into competition with well-established institutions which already have the trade, but there should be no middleman between the co-operative establishment and the retailer.

It is a well known fact that in the United States of America some millions of eggs are held in cold storage, so that the question of dealing

with them effectively in this manner is already solved. Care has, of course, to be taken in selecting only fresh eggs, and in carefully sorting them into different sizes so that they can be classified and sold according to weight.

The question of Farmers' Associations establishing their own freezing works to deal with sheep and cattle will also have to be considered in the near future, as there is no reason why a lucrative business of this nature should be completely under the control of what we may term foreign companies. This would entail the investment of a large amount of capital, and may well be left until the stock already in the country has increased to such an extent as would justify the establishment of freezing works, and to the time when we have Land Banks, through which these concerns would be financially supported.

There is no reason why the Transvaal should not establish a large fruit exporting industry, and we could begin by making some effort to regulate the supply of fruit to our own markets.

At present peaches are obtainable on the market here at 1s. per 100, and I have no doubt but some farmers are finding it unremunerative to place them on the market at such a low figure, while a few months hence peaches will be unobtainable at any price.

The establishment of properly equipped cold storage chambers in the fruit-growing centres would enable the farmers to store their fruit for a few months, and place it on the market as required.

I trust the points I have touched upon will be of interest to you.

Yours, etc.,

J. DALRYMPLE.

Johannesburg.

* * * *

DEEP SUBSOIL TILLAGE.

To the Editor of the Agricultural Journal.

Sir,—As agriculture and the study thereof is gradually forging ahead, and taking its right place in the Transvaal, it behoves every farmer and everyone else to do all that lies in their power to go the right way to work, and aid the Government which has done so much for the agricultural interest of the Transvaal. In this letter I shall only quote one item, but which I consider the most important to us here as an agricultural community : that is *Deep Subsoil Tillage.*

Now, sir, I have been a farmer all my life, and have gone in for agriculture in different parts of the Cape Colony and Transvaal, but nowhere have I come across such a hard and fast subsoil. You may have an idea when I say that a rain of two days' duration only gives you one week for fallowing when the soil is as hard as a brick ; on the other hand if a rain continues very much longer you have your crops drowned. It stands to reason that the rain cannot penetrate on account of the hard layer of waterproof turf brak subsoil, and the consequence

is that the rainwater runs off all of a sudden and evaporation goes on more freely. The soil cannot absorb the water and so retain the moisture for any length of time, hence our poor crops and the impoverished state of our community. I am not long in this part, but I have given it a good look, and I have come to the conclusion that what we want is *deep ploughing*—18 inches to 2 feet if possible. I have advocated this now for some time, and I am glad to say that all my neighbours have come round my way of thinking, and will but be only too willing to add their quota towards defraying the expense of getting a steam-ploughing plant out here. I, for my part, will guarantee the carriage of the whole plant from Balfour Station on to this farm. Just now I am using 40 full-grown powerful oxen and 3 double-furrow ploughs, but it all means time wasted, labour lost, and expenses incurred for which you have no adequate return. For it is only the third season that you can expect some sort of a crop.

I feel confident that when once this method of turning over the soil has been introduced here, it will be the rule just like the thrashing machine. Our chance for giving the steam plough free scope lies in this, that we can guarantee stretches of land from one-half to two miles square *as level as a table and without a stone.* In the old way it will take me at least two seasons hard ploughing, and after that what have I got—a lot of expense, and ground imperfectly worked, and from which I can only expect a crop after the third season.

Yours, etc.,
G. S. CRUSE.

Balfour, Heidelberg.

DEPARTMENTAL NOTICES.

AVAILABLE PUBLICATIONS.

The following publications, amongst which are included several recent additions, can be had, free of charge, on application to the Government Printer, Box 373, Pretoria :—

Transvaal Agricultural Journal, No. 3. Vol. I. (Published quarterly)
" " " No. 4, Vol. I. " "
" " " No. 10, Vol. III. " "
" " " No. 13, Vol. IV. " "
" " " No. 14, Vol. IV. " "
" " " No. 15, Vol. IV. " "
" " " No. 16, Vol. IV. " "
" " " No. 17, Vol. V. " "
" " " No. 18, Vol. V. " "

Division of Botany :—

Leaflet No. 1.—" Plants Poisonous to Stock."
" No. 4.—" The Cockle-Burr " (English and Dutch).
Bulletin No. 1.—" Conditions of Seed and Plant Distribution."
Circular No. 1.—" Poisonous Plants " (English and Dutch).

Division of Entomology :—

Leaflet No. 7.—" The Spraying of Locusts " (English and Dutch).

Division of Forestry :—

" Price List of Seeds and Trees " (English and Dutch).

Division of Horticulture :—

Bulletin No. 1.—" Some Information about Fruit Trees " (English and Dutch).
Leaflet No. 1.—" On Summer Pruning " (English and Dutch).
" No. 2.—" On Thinning Out Fruit."
" No. 3.—" A Fruit Report " (English and Dutch).
" No. 4.—" Diseases of Orange Trees " (Dutch and English).

Division of Publications :—

Bulletin No. 1.—" Burrweed or Boete Bosch."
" No. 2.—" Some Diseases of the Horse."
" No. 3.—" The Food of Plants."
" No. 6.—" City and Town Milk Supply and the Care and Aeration of Milk " (English and Dutch).

Division of Veterinary Science :—

Bulletin No. 1.— " Measles in Swine and Cattle " (English and Dutch).
" No. 6.—" Contagious Abortion " (English and Dutch).
Leaflet No. 3.—"Rhodesian Tick Fever " (English and Dutch).
" No. 5.—" Glanders and Farcy"

Miscellaneous :—

Transvaal Forest Report.
Agriculture within the Empire.
Bulletin No. 1.—" The Brands Directory, 1904 " (Dutch), 1d.
" No. 1.—Department of Irrigation and Water Supply : " The Design and Construction of Small Reservoirs for Irrigation and for Stock."
" No. 2.—Department of Irrigation and Water Supply : " The Design and Construction of Small Irrigation Canals."
Annual Report of the Director of Agriculture for the year 1903–04.
" " " " " " 1904–05.

JOURNAL FILES.

In order that our numerous readers may not be disappointed by being unable to complete their files, we would earnestly request them to preserve all copies of the *Journal*, if they propose to bind them at the close of the year. Owing to the expense incurred in publication, it has become necessary to limit the number of copies issued, and it often happens that we cannot supply back numbers, as they are out of print.

Indices for the *Agricultural Journal*, Vol. I., Vol. II., Vol. III., and Vol. IV., can be had on application to the Department of Agriculture.

* * *

JOURNAL DUPLICATES.

Any readers who possess and can spare duplicates of the *Agricultural Journal* would confer a great favour by returning them to the Department of Agriculture, as back numbers are now out of print, and applications are constantly being made by persons desirous of completing their sets.

* * *

ADDRESS.

Correspondents are earnestly requested to give their full name and correct postal address when forwarding any communication to the Department. It sometimes happens that readers send their farm address only, and fail to give the Post Office address, consequently it is impossible to reply to their queries or send publications. This refers more especially to farmers applying for cattle permits, as in many cases letters forwarded by the Veterinary Division are returned by the Postal Authorities to the effect " Not delivered. Address insufficient." The Department should also be immediately notified of any change of address.

* * *

APPLICATIONS FOR THE JOURNAL AND NON-DELIVERY.

Applications to be placed on the Mailing List of the *Journal*, as well as complaints as to non-delivery of the *Journal*, should be addressed to the Government Printer, P.O. Box 373, Pretoria, and not to the Editor of the *Journal*. It is particularly requested that changes of address should also be promptly notified to the Government Printer, in order to ensure prompt delivery to addressees and to avoid unnecessary correspondence.

The *Agricultural Journal* is distributed free in the Transvaal only, and the attention of subscribers in the other South African Colonies and Oversea is kindly requested to the Government Printer's Notice on the tinted page at the commencement of this number.

* * *

* GOVERNMENT STALLIONS FOR PUBLIC STUD.

Applications to hire stallions for next season should be made before July 15th, on which date these applications will be considered.

As the number of stallions is limited, preference will be given to owners of the best class of mares.

TERMS.

Stallions will be leased to individuals, associations, or two or more breeders in conjunction, approved of by the Department.

The Lessee or Lessees to allow the farming public to send mares for service at a fixed fee, provided the list is not already full, the fees to be according to the following tariffs, viz. :—

Prices paid for hire of Stallion.	*Fee to be charged by Lessee not to exceed*
£25	30s.
£30	35s.
£40	45s.
£50	55s.
£60	65s.

The charge for the hire of the majority of the stallions will range from £25 to £35, but for a few exceptionally high-class animals somewhat higher rates will be made.

Payment for hire of stallions to be made in advance.

Not more than 40 mares to be served by a stallion without written permission.

* This notice has already appeared in the daily press.—*Editor.*

Stallions will be delivered by the Department at the nearest railway station to the place where they are to stand at stud, and expense of railage will be borne by the Department. At the termination of the season the stallion will be taken over by the Manager of the Government Stud Farm, or his representative.

Stallions will not be allowed to run with mares unless by special arrangement.

Due care must be taken that stallions shall not serve mares suffering from any contagious diseases.

The Manager of the Stud Farm or his representative to have the right to inspect the stallions leased at any time.

In the event of a stallion dying during the period for which he has been leased, from any cause through which the lessee is to blame, the lessee will be liable for a sum equal to the price already paid for the hire of the same.

The lessee to be responsible for the good care and attention of the stallion and his equipment.

Should any of the foregoing rules not be complied with, the Department shall have the right to remove the stallion at once, and to take any action desirable for the recovery of damages, the lessee to forfeit the money paid for hire.

Applications must be addressed to the Manager, from whom any further information can be obtained.

F. B. SMITH,
Director of Agriculture.

A. McNAE,
Acting Manager.

* * *

DIVISION OF FORESTRY.

TARIFF FOR POLES AND FIREWOOD FROM GROENKLOOF PLANTATION, PRETORIA.

It is notified for general information that the Groenkloof Plantation having been transferred to the Municipality, all applications and correspondence in connection therewith should be addressed to the Town Engineer, Pretoria, and not to the Department of Agriculture.

* * *

PRICE LIST OF TREES AND SEEDS.

The price list of trees and seeds supplied by this Division, which was printed in full under "Departmental Notices" in the last number of the *Journal*, has now been issued as a separate publication, and can be obtained, free of charge, on application to the Conservator of Forests, or the Government Printer, Pretoria.

* * *

NOTICE No. 542 OF 1906.

GRANTS-IN-AID OF TREE PLANTING.

It is hereby notified that the Government is prepared to contribute towards the expenses of Tree Planting, undertaken by Municipalities, Agricultural Societies, and other Public Bodies.

The conditions under which the grant will be made are:—

(1) There shall be submitted to the Director of Agriculture for approval, as soon as possible after the 1st of July in each year, a plan of the place or places or streets where it is intended to plant, a list of the kinds of trees to be planted, and also an outline of the methods to be employed in preparing the ground for the trees and for protecting them. The total number of trees to be planted and the total estimated cost should be stated.

(2) The completed work shall be inspected and compared with the approved working plan, and for any unauthorised departure from the plan submitted to be approved by the Director of Agriculture a deduction may be made from the expenditure account.

(3) Street trees shall not be planted on the pavement or furrow or be spaced nearer than 15 feet apart. They must be securely fenced.

(4) Different kinds of trees shall not be mixed.

(5) Plantations shall be protected against fire.

(6) A separate account shall be kept of all monies expended on tree planting, and shall always be open for Government inspection, and a statement of accounts signed by the Chairman and Secretary and countersigned by the local Magistrate shall be submitted to the Director of Agriculture not later than the 1st of June in each year, so that the grant may be paid before the end of the financial year (June 30th).

(7) On approval of the Director of Agriculture, or his Deputy, of the work undertaken, and of the accounts for the same, a sum (not exceeding £100 for any one

body) equal to half the total expenditure incurred in tree planting shall be refunded to the Municipality, Agricultural Society, or other Public Body concerned.

(8) As the money available for this scheme is limited, applications will be dealt with in the order in which they are received, till the whole sum has been allotted.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture,
Department of Agriculture.
Pretoria, September, 1906.

* * *

DIVISION OF BOTANY.

Seed Distribution.

A list of seeds available for farmers who are willing to conduct experiments in co-operation with the Division has been published as Bulletin No. 1, and may be obtained on application to the Government Printer. Terms on which the seeds will be issued are stated in the Bulletin, and application forms will be found within the cover. Notes are given as to the uses of the plants and as to how the seed should be treated.

Cockle-Burr.

On account of the dangerous character of this weed to wool and mohair growers, farmers on the Aapjes, Pienaars, and Crocodile Rivers are advised to keep a sharp look-out for its appearance, especially on the banks of the rivers, and to root out the plants before they go to seed. Any farmer who is in doubt as to the identity of Cockle-Burr can send specimens to the Botanist for identification.

* * *

DIVISION OF CHEMISTRY.

Instructions for the Sampling of Soils.

In taking soil for analysis, it is of the utmost importance that a truly representative sample be secured, otherwise the labour involved will, to a great extent, be wasted.

Much depends upon the particular object for which the analysis is to be made. If the soil of a farm or field is to be reported upon, and much difference exists in the soil from different parts, each variety of soil should be represented in the final sample by a quantity proportional to the aliquot portion of the whole area covered by that particular soil.

If great differences are known to exist in different parts of the farm or field, better knowledge of the nature of the soil will be obtained, of course, at the cost of greater labour in analysis, if the samples are kept separate.

The *depth* to which a sample is taken is also a matter of importance. In some cases a clear line of separation between the soil proper and the sub-soil is perceptible. This is often shown by difference in colour, the soil being richer in organic matter, and therefore darker than the sub-soil. Under such circumstances the sample of soil should be taken down to the line, and, if necessary, a sample of sub-soil should also be secured. When no distinction is perceptible, the sample should be taken to the depth of one foot.

Methods of Taking Samples.

There are many ways of taking samples of soil. The following, perhaps, will be found most convenient in this country:—

(1) Having selected a representative spot, the vegetation upon it is removed, and a hole is dug with a sharp spade to a depth rather greater than that of the soil proper, or, if no line of separation of soil from sub-soil is perceptible, to about 15 inches. One side of the hole is then trimmed with the spade so as to be smooth and vertical, the hole being cleaned out. A slice of uniform thickness, about 3 or 4 inches, is then removed by the spade down to the necessary depth. This slice is placed on a clean board or sack and mixed with similar slices, obtained in the same way from other parts of the field. Finally, all the samples are thoroughly mixed together with the trowel or the spade, the sticks, large stones, and roots removed, and a portion of six or seven pounds placed, with a label giving details, in a clean box and sent for analysis.

(2) Another, better but more laborious, method is to have wooden boxes, 6 inches square and 12 inches deep, to hold the samples. A large hole is dug with a spade at the selected spot, and a square upright block of soil is left in its centre. This is carefully trimmed with the spade until a box will just fit over it. The upper surface of the block of soil is freed from vegetation, the box inverted over it, and forced down. The spade is next slipped under, and the box with its contents removed, a label giving particulars of the soil put in, and the lid screwed on. In this way a sample of the soil (and often the sub-soil, *in situ*) is obtained, which can be examined in the laboratory.

WHAT TO DO WITH THE SAMPLES.

In all cases full details as to the exact locality, date of collection, depth, crops borne, previous manurial treatment, and other circumstances connected with the soil should be enclosed with the sample. These should be written in pencil, as ink is apt to become damp and run.

Samples should be sent by passenger rail, addressed to me at the Agricultural Chemical Laboratories, Pretorius Street, Pretoria, and advice of their despatch, together with details of the samples, should be sent by post to the same address.

While every effort will be made to deal with the samples as soon as possible, for a time, at least, some delay may be unavoidable, owing to the large accumulation of material awaiting analysis. *No attention will be paid to samples sent without the full details stated above.*

A list of charges for the analysis of soil and other products is published below, but in cases where it is considered that the results may be of sufficiently general interest, if published, no charge will be made.

HERBERT INGLE,
Chief, Division of Chemistry.

* * *

SCHEDULE OF CHARGES FOR ANALYSIS MADE IN THE AGRICULTURAL LABORATORIES.

		£	s	d.
1.	Estimation of one constituent in a manure or feeding stuff ..	0	7	6
2.	Estimation of two or three constituents in a manure or feeding stuff	0	15	0
3.	Complete analysis and valuation of a manure or feeding stuff ..	1	0	0
4.	Analysis of water—drainage or irrigation	1	5	0
5.	Partial analysis of a soil to determine fertility and manurial needs	2	0	0
6.	Complete analysis of a soil	3	0	0
7.	Analysis of milk, cream, butter, or cheese	0	10	0
8.	Milk—determination of fat and total solids	0	5	0
9.	Milk—determination of fat only	0	2	6
10.	Butter—determination of water and fat	0	5	0
11.	Analysis of a vegetable product—hay, ensilage, roots, etc. ..	1	0	0

At present no charge will be made to *bona fide* farmers. The charges in the above schedule refer to products sent by manure merchants, milk dealers, or others interested in trade. Samples will only be accepted if assurance can be given that they are properly taken and truly representative of the bulk. The right of publishing the results of any analysis is reserved by the Department. Should the examination of any product furnish results which are deemed of sufficient general interest, the charges may be remitted.

Samples of any product likely to be of agricultural importance will gladly be received.

* * *

SPONZIEKTE OR QUARTER EVIL.

Vaccine for the prevention of this disease is now ready for issue at the Government Veterinary Bacteriological Laboratory, and can be obtained through the Government Veterinary Surgeons, who will give instruction in the method of vaccination, and through whom also the necessary instruments can be obtained. The price of the vaccine is 3d. per double dose.

* * *

LIST OF OFFICIALS.

The following is a list of the officials of the Transvaal Department of Agriculture, to whom inquiries respecting matters connected with agriculture may be addressed:—

Director	F. B. SMITH.
Assistant Director	A. C. MACDONALD.
Division of Veterinary Science.	
(a) Bacteriology	A. THEILER.
(b) Contagious Diseases	C. E. GRAY.
Division of Chemistry	HERBERT INGLE.
Division of Botany	J. BURTT-DAVY.
(a) Plant Pathology	I. P. POLE-EVANS.
(b) Seed Introduction and Plant Experiments	H. G. MUNDY.
Division of Forestry	CHARLES E. LEGAT.
Division of Entomology	C. W. HOWARD (Act.).
Division of Horticulture	R. A. DAVIS.
Division of Tobacco	J. VAN LEENHOFF.
Division of Publications	WILLIAM MACDONALD

Division of Poultry	REGINALD BOURLAY.
Government Stud Farm, Standerton	A. McNAB (Act.).
Government Experimental Farm, Potchefstroom	ALEXANDER HOLM.
Government Experimental Farm, Ermelo	H. NICHOLSON.
Government Experimental Farm, Tzaneen	H. S. ALTENROXEL.
Translator	OTTO MENZEL.
Registrar of Brands..	J. J. PIENAAR.

* * *

ASSISTANCE IN IMPORTATION OF BREEDING STOCK.

Notice is hereby given that with the object of encouraging the importation of breeding stock into the Transvaal Colony the Government is prepared to grant assistance to *bona fide* farmers as follows:—

1. A grant, not exceeding £20 to any individual, towards defraying half the cost of railage from any station in South Africa to any station in the Transvaal on sheep and Angora goats imported solely for breeding purposes and being the property of the applicant
2. Claims to be supported by a duly receipted voucher of the Railway Department at place of entraining.
3. Applicants for this refund to undertake to preserve and maintain the said stock for a period of not less than two years from date of payment of the grant.
4. Applicants must agree not to sell, or otherwise dispose of, or slaughter any of the stock without the permission of the Commissioner of Lands. Permission to slaughter to be given only in the event of the stock proving incapable of breeding.
5. Failing the faithful observance of the conditions the Commissioner of Lands shall call upon the farmer for an immediate refund of the grant.
6. In cases of dispute the decision of the Commissioner of Lands to be accepted as final.
7. Applications for the grant to be made through the local Magistrate or Resident Justice of the Peace, who will furnish a form to be completed and forwarded to the Director of Agriculture for consideration.
8. If desired the stock can be carried on any of the South African Railways at the expense of the Government, provided an amount equal to half the cost of such railage be first deposited with the Director of Agriculture.
9. As the amount of these grants is limited to the sum of £3 000 in the present financial year, applications will be dealt with in the order in which they are made.

F. B. SMITH,
Director of Agriculture.

Department of Agriculture,
Pretoria, 31st October, 1905.

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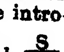
SUMMARY OF DEPARTMENTAL INSTRUCTIONS FOR THE GUIDANCE OF STOCK INSPECTORS AT TRANSVAAL PORTS OF ENTRY.

(Animals will be inspected only between the hours of sunrise and sunset.)

No. 1.—CATTLE.

No cattle will be admitted into the Transvaal by road or rail unless the owner has previously applied for and obtained a written permit from the Department of Agriculture, Pretoria. This permit must be presented to the Stock Inspector along with the animals at the Ports of Entry specified in the permit.

In making application for this permit the following particulars must be furnished:— Name of owners; locality from which the cattle come; purpose for which they are being introduced; number of animals to be introduced (if coming by rail: station at which they are to be trucked; station at which they are to be derailed) · name of consignee and ultimate destination of the animals. These particulars are required for the information of the Advisory Committee of the Ward or District into which the cattle are to be introduced, by whom all permits have to be recommended before they are issued.

SLAUGHTER CATTLE will be branded at the Port of Entry with the brand  *on the left side of the neck before proceeding to their destination if this has not been already done by the consignor before shipment*

No. 2.—EQUINES.

All persons introducing equines into the Transvaal must produce certificates for their animals signed by a qualified Veterinary Surgeon holding the Diploma of the Royal College of Veterinary Surgeons, England, stating that the animals are free from disease

and that they have been tested with mallein and have reacted in a normal manner. These certificates will be collected by the Stock Inspector at the Port of Entry. If any horse is presented for admission without a certificate it will either be tested with mallein by the Stock Inspector and allowed to enter after the Inspector is satisfied that the animal is free from disease, or it may be allowed to proceed to its destination and tested there, whichever course is most convenient for the Department.

Exceptions.

Equines which are engaged in to-and fro movements across the border. Equines which have recently come from the Transvaal and are returning thither.

Racehorses in training will be allowed to proceed to their destination upon the owner giving an undertaking to report their arrival to the Government Veterinary Surgeon of the District, and to submit the imported animals to the mallein test if the Government Veterinary Surgeon considers this necessary. All other equines will be detained and tested unless the owner has previously made other arrangements with this Department.

No. 3.—Sheep.

Sheep are subject to examination at the Port of Entry and liable to detention if found affected with scab.

No. 4.—Pigs.

Pigs from Cape Colony are now allowed to enter the Transvaal if the following conditions are observed:—The person desiring to introduce swine into this Colony from Cape Colony shall make application to the Director of Agriculture, Pretoria, stating the place from which and the person from whom the swine are being obtained, and giving particulars as to their number, destination, and the purpose for which they are being introduced, he shall further submit with such application a certificate signed by the Chairman of local authority of the district from which the animals are to be brought and endorsed by the Chief Veterinary Surgeon or his representative to the effect that such swine are free from swine fever, and that there has been no swine fever in the place from which they have been immediately obtained.

Upon receipt of such documents the Director of Agriculture may grant and transmit a permit authorising the introduction of such swine. Such permit shall be sent with the animals, and shall be handed over to the Stock Inspector at the Port of Entry.

Permits for the introduction of pigs from other Colonies are not required.

C. E. GRAY,
Principal Veterinary Surgeon.

* * *

WARNING TO IMPORTERS.

The attention of the Department has been directed to the fact that certain imported cattle brought into this country under certificates stating that they have been tested with Tuberculin before shipment and have passed the test satisfactorily, have been found to react as infected when re-tested by the Government Veterinary Staff shortly after arrival. For this reason it is suggested that importers of cattle should have such imported animals re-tested by a Government Veterinary Surgeon on arrival at their destination, and before they are allowed to mix with other stock. Should anyone wish to take this precaution the test will be applied free of charge upon application to the Government Veterinary Surgeon of the District to which the cattle are taken, at the earliest convenience of this Officer to whom the application is made.

F. B. SMITH,
Director of Agriculture.

* * *

NOTICE.

It is hereby notified for general information that the Department has been advised by the Commissioner, Nairobi, British East Africa, that sheep and goats may now be imported from the South African Colonies into British East Africa if accompanied by a Veterinary Certificate certifying that the animals are in good health.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture,
Pretoria, October 1st, 1906.

POISONOUS PLANTS.

The Division of Botany and Division of Veterinary Science are carrying on a series of joint investigations on the poisonous plants of the Colony, their effect on stock, and the remedies to be applied.

Last year we invited farmers to send specimens of poisonous plants for identification and are glad to be able to extend the invitation this year.

Any farmer who has poisonous plants on his farm, and would like information about them, may send samples to the Department for investigation. These samples will be identified and named, will be tested on animals kept for the purpose, the symptoms will be carefully diagnosed, and different remedies will be tested. A report of the results will be sent to the person furnishing the specimens.

For an effective test, samples of at least 5 lbs. of the material should be sent, but smaller samples will also be welcome for identification and preliminary report.

Through the courtesy of the Postmaster-General, specimens may be sent by post, free of charge, if fastened up as letters and addressed :—

O.H.M.S. Letter Post.
The Government Botanist,
Department of Agriculture,
P.O. Box 434,
Pretoria.

CO-OPERATIVE EXPERIMENTS : COTTON.

Cotton-Seed Donated by the British Cotton Growing Association.

The Department has received a large consignment of American Upland Cotton Seed from the British Cotton Growing Association. This seed will be distributed to any *bona fide* farmer who wishes to give the crop a trial, in sufficient quantity to sow one acre (209 x 208 English feet).

The amount of seed required will be as follows :—

For the Low Veld, sowing 4 x 3 feet, 3 lbs. of seed.
" Middle Veld " 4 x 1½ " 5 to 6 lbs. of seed.
" Middle Veld " 4 x 1 " 7 to 9 " "

(the thicker sowing is advisable at higher altitudes where the climate is rather cooler).

The farmer is required to pay all carriage and transport charges from Pretoria to his farm (freight from America to Pretoria has been paid by the Association and the Department).

The farmer must sign and return the attached form of agreement either to the Government Botanist or to the Resident Magistrate.

This agreement is made necessary by the conditions under which the Association has supplied the seed. These conditions read "That all the cotton grown from this seed shall be shipped to the Association for sale, and if the experiment proves successful the cost of the seed shall be refunded to the Association, that other experiments may be conducted; . . . . if the experiments are a failure they (the farmers) will be called upon to pay nothing; if successful, the Association will dispose of the cotton for their account, and deduct the cost from the proceeds."

The Association has agreed to supply the Department with two hand-gins, which we intend to loan out to each district. Application for the use of these gins should be made in due course to the Resident Magistrate.

A pamphlet entitled "Hints on the Cultivation and Harvesting of Cotton," has been issued by the British Cotton Growing Association; a few copies are still available, one of which will be sent to each farmer receiving seed, as long as the supply holds out.

For further information on Cotton Cultivation, etc., growers are referred to the articles and notes which have appeared in the *Transvaal Agricultural Journal* during the last 18 months, particularly the following:—

Cotton Growing in the Transvaal: *Agricultural Journal*, No. 12, pp. 739–745. (July, 1905.)
Cotton as a Possible Crop for the Transvaal: No. 8, pp. 595-599. (July, 1904.)
How to Estimate the Yield of Cotton-lint per Acre: No. 9, p. 174.
Weight of a Bale of Cotton: No. 9, p. 174.
Transvaal Cotton; Reports from the Imperial Institute: No. 9, pp. 136–137; No. 11, pp. 554–556.
Cotton in South Africa: No. 9, pp. 130–131.

Transvaal Native Cottons: No. 9, p. 131 and pp. 136–137.
Cotton in the Low Veld of the Eastern Transvaal: No. 10, p. 316.
Zoutpansberg Cotton: No. 9, pp. 136–137; No. 11, p. 554.
Swaziland Cotton: No. 9, p. 137.
Cotton in the Marico and Rustenburg Districts: No. 12, pp. 863–864 and 842.
Cotton at Malelane: No. 13, October, 1905, pp. 152-155.

JOSEPH BURTT-DAVY,
Government Agrostologist and Botanist.

THE GOVERNMENT AGROSTOLOGIST AND BOTANIST,
TRANSVAAL DEPARTMENT OF AGRICULTURE,
P.O. Box 434,
PRETORIA.

CO-OPERATIVE EXPERIMENTS: COTTON.

SIR,

Please forward me by*..
carriage forward, to..Station, in care of..., Forwarding Agents,...................................lbs. of cotton seed.

I agree to furnish you with a full and accurate report, at the end of the season, as to the results of the experiments, on the forms to be supplied by you.

In the case of the experiment being successful, I also agree to ship the whole of my crop of cotton to the British Cotton Growing Association for sale, and I will allow the aforesaid Association to deduct the cost of the seed from the proceeds thereof.

Date.................................

Sign here...

Two witnesses. ....
....

Full P.O. Address...
....

* * *

GOVERNMENT NOTICE No. 242 OF 1906.

GRANTS-IN-AID OF AGRICULTURAL SOCIETIES AND OTHER SIMILAR ORGANISATIONS.

Notice is hereby given that for the purpose of assisting Agricultural Societies and other organisations formed for the promotion of the agricultural industry, the Government will be prepared to make grants-in-aid to such societies on the following conditions:—

1. Ten shillings for every £ raised by subscriptions, donations, and gate money, the proceeds of which are devoted to the ends specified above. No grants to be made against "value" contributions.

2. Special grants, when funds are available, against the costs actually and *bona fide* incurred in the future construction of buildings on, or other permanent improvements to, agricultural societies' grounds, provided that such buildings or improvements remain unalienated and vested in the Chairman or Secretary as trustee of the subscribers.

3. The Registrar of Deeds will be notified of all grants made under Clause 2, and will register same against the transfer of the property concerned.

4. The grants will be subject to the approval of the Commissioner of Lands, who will deal with the applications as they are received, fixing a maximum sum to be granted, if he deem necessary, having regard to the funds at his disposal, and the needs of the society concerned.

5. The Commissioner of Lands may alter the conditions under which any grant is made when, in his opinion, it is desirable to do so.

6. Grants will be paid annually on production of a statement of receipts and expenditure signed by the Chairman of the society or club, and bearing a certificate as follows:—

"I hereby declare the above to be a true and faithful statement of the receipts and expenditure of the...................................during the period from................to................and that no grant has already been claimed from the Government in respect of any portion of the receipts here shown."

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* State whether the seed is to be sent by Passenger or Goods Train or by Parcels Post. If it is to be sent by Post, 8d. per lb. for postage should be enclosed with the application.

Such declaration to be made before the local Magistrate or Resident Justice of the Peace, and who will also declare as follows:—

"I certify that to the best of my knowledge and belief the above statement is correct and that the society is entitled to a grant from Government under the conditions laid down in Government Notice No. 242 of 1906."

7. Claims intended for payment before the end of each financial year should be submitted not later than the 30th April.

They must be in respect of subscriptions and donations, etc., received during the twelve months ending on the 31st March of each year, and not prior to the commencement of that period, unless no claim has been made in the previous year.

8. Applications for grants should in all cases be forwarded through the local Resident Magistrate or Resident Justice of the Peace.

9. Copies of the audited balance sheet and the annual report of the society or club should be forwarded to the Department of Agriculture as soon as published.

A. C. MACDONALD,
Acting Director of Agriculture.

Office of the Director of Agriculture,
Pretoria, 5th March, 1906.

* * *

EXPERIMENTAL FARM, POTCHEFSTROOM.

Stock and Seeds for Disposal.

Pigs.

Pure-bred boars and sows about 4½ months' old of the following breeds:—Large White Yorkshire, Tamworth, and Large Black. Price 50s. each, f.o.r. Potchefstroom.

Seeds.

Limited quantities of the following seeds are available for disposal. The quantity to be allotted to each applicant will be determined by the orders received, and in the case of shortage preference will be given to applications in order of their priority:—

Wheat.

Price 12s. per 100 lbs., f.o.r., Potchefstroom.

Variety.	*Remarks.*
New Era	Red, Late and Bearded.
Red King	Late and Beardless.
Red Stand Up	" "
Rough Chaff White	" "
Red Nursery	" "
Fourie	Early, White and Bearded.
Rietti	Early, Red and Bearded.
New Zealand Red	" "
White (local)	Early and Beardless.

The varieties termed Late are Heavy Cropping winter varieties and very hardy against frost. They should be sown early.

Oats.

For "Oat forage" or "Oathay."

Price 12s. per 100 lbs., f.o.r. Potchefstroom.

Variety.	*Remarks.*
Winter (English)	Late, Heavy Cropper of excellent quality. Should be sown early.
White Egyptian	Early.
Algerian	Early.
"Cape"	Early.
"Boer"	Very early. Should only be sown on fertile land.

For Growth of Grain to be Thrashed.

Black Tartarian Sutton's Newmarket Garton's Abundance	Straw course in growth, but makes good fodder for stock.

Barley.

Price 12s. per 100 lbs., f.o.r. Potchefstroom.

Variety.

2 Rowed (Malting).
6 " (Transvaal).

RYE.

Early variety, about three weeks earlier than barley. Price 12s. per 100 lbs., f.o.r. Potchefstroom.

These varieties of grain are the best of different kinds which have been experimented upon at this farm. The seed is well grown and clean, has been well dressed, and is free from "smut" or "bunt."

POTATOES.

Seed fit for planting end of January and February. Price 12s. 6d. per bag of 160 lbs., f.o.r. Potchefstroom.

Variety.	*Remarks.*
White Hebron	Very early.
Early Rose	Early.
Sutton's Flourball	Medium early.

Applications for these stock and seeds should be sent to the General Manager, Experimental Farm, Potchefstroom, and orders must be accompanied by Cheque or Postal Order.

The above prices are subject to alteration without notice.

ALEX. HOLM,
General Manager.

* * *

STALLION FOR PUBLIC STUD.

The Clydesdale Stallion "Transagric,"

	No. of Sire.
Sire, Royal Chief	10,876
1st Dam, Minnie, Vol. XXVIII., by Barons Pride	9,122
2nd Dam, Brenda, 2nd 12,871, by MacGregor	1,487
etc., etc.,	

will stand at stud at the Experimental Farm, Potchefstroom, at the service fee of £2 2s.

"Transagric" is a black horse, of fully 16 hands, on strong and short limbs, with good feet and pasterns, is full of muscle and quality, and exceedingly well coupled. He is recommended for van or draught purposes.

Arrangements can be made with the General Manager, Experimental Farm, Potchefstroom, for mares to remain at this farm during the service season at reasonable charges for keep and attendance.

ALEX. HOLM,
General Manager.

* * *

SOME RECENT ADDITIONS TO THE LIBRARY OF THE DEPARTMENT.

SOUTH AFRICA.

Trade of the Colonies and Territories forming the South African Customs Union, for Nine Months ending September 30, 1906, and for the Month of October, 1906.
South African Stud Book, Vol. I., 1906.

CAPE COLONY.

The Agricultural Journal.
Reports of the Acting Chief Conservator of Forests and Conservators of Forests Cape Colony, for the year ended September, 1905.
The Government Gazette.

NATAL.

Report of the Government Bacteriologist, 1904-5.
The Agricultural Journal.

ORANGE RIVER COLONY.

Department of Agriculture.

Leaflet No. 1. Address delivered by the Director of Agriculture before the Legislative Council, July, 1906.
Bulletin No. XII. Poultry Parasites. C. Mc. G. Johnston.

TRANSVAAL.

Minutes of a Meeting of the Transvaal Agricultural Union, held at Pretoria, 10th-13th July, 1906.

The Legislative Council. Votes and Proceedings, VI. Session, 1906.
" " Reports of Select Committee, VI. Session, 1906.
1st, 2nd, 3rd, 4th, and 5th Reports of the Commission appointed to report on the Public Service.
Report of Special Committee appointed to enquire into the Present Conditions in regard to the Control of Chinese Indentured Labourers in the Witwatersrand District.
Results of the Census of the Transvaal Colony and Swaziland (Final Report).

RHODESIA.

The Agricultural Journal.

GREAT BRITAIN.

Report of the British Association for the Advancement of Science (South Africa), 1905.

Board of Agriculture and Fisheries.
The Journal of the Board.
Leaflet 167. Ducks and Duck Breeding.
Leaflet 168. Hints on the Formation of Permanent Pastures.

Midland Agricultural and Dairy College.
Reports on Experiments with Crops and Stock in the Year 1905-6.

University of Leeds and the Yorkshire Council for Agricultural Education.
No. 60. Milk Investigations at the Manor Farm, Garforth, 1905.
No. 61. Report on a Test of 13 Varieties of Wheat at Garforth. 1906.
No. 62. Variation in the Composition of Butter Fat.
Transactions of the Highland and Agricultural Society of Scotland. Vol. XVIII., 1906.

INDIA.

The Agricultural Journal of India.
The Agricultural Ledger.
The Agricultural Gazette, published under the orders of the Director of Agriculture, Central Provinces, Nagpur.

Department of Agriculture. Madras.
Bulletin No. 56. The varieties of Cultivated Pepper. C. A. Barber.
Report on the Seasons and Crops of the North-West Frontier Provinces for the year 1905-6.
Land Records. Administration Report for the year ended June 30, 1906.

Bengal Agricultural Department.
Record of Agricultural Experiments, Season, 1904-5.
Annual Report of the Dumraon Experimental Farm for 1904-5.
Season and Crop Report of Bengal for the year 1905-6.
Report of the Operations of the Department of Land Records and Agriculture, Punjaub, for the year ended September 30, 1905.

CANADA.

Ontario Department of Agriculture.
Bulletin 147. Fruits recommended for planting in Ontario.
27th Annual Report of the Ontario Agricultural and Experimental Union, 1905.
Report of the Farmers' Institutes of the Province of Ontario, 1905.
Ontario Agricultural College Bulletin 149. The Swine Industry in Ontario.
Bulletin 151. Farm Poultry. W. R. Graham.

Province of Saskatchewan Department of Agriculture, Statistics Branch.
Bulletin No. 4. Condition of the Crops at Harvest Time. September 20, 1906.

Province of Alberta Department of Agriculture, Statistics Branch.
Crop Bulletin No. 3.
Estimated yield of the Principal Grain Crops. August 20, 1906.
Supplement to Crop Bulletin No. 3. September 21, 1906.

Department of Agriculture. Central Experimental Farm, Ottawa.
Bulletin No. 54. The Breeding, Feeding and General Management of Poultry.
Part I. A. G. Gilbert.
Par II. V. Fortier.

AUSTRALASIA.

Victoria.—The Agricultural Journal.
New South Wales.—The Agricultural Gazette.
Queensland.—The Agricultural Journal.
Western Australia.—The Agricultural Journal.
South Australia.—The Agricultural Journal.

NEW ZEALAND.

Department of Agriculture.—Dairying Division.
Report for 1904-5.
Bulletin 7. (*a*) The Acidimeter and its use. (*b*) The Preparation of Starters.
Bulletin 8. Review of the Work of the 1905-6 Season.

Leaflets for Farmers.
No. 76. The Manuring of Potatoes.

Chemistry Division.
Bulletin 1. Phosphates in New Zealand.

Viticultural Division.
Viticulture in New Zealand, with special reference to American Vines. R. Bragato.
Agriculture in other Lands, with special reference to Dairying. J. A. Kinsella.

WEST INDIES.

Board of Agriculture, Jamaica.
Report on the Experimental Work of the Sugar Experiment Station for the year 1905.
Bulletin of the Department of Agriculture, Jamaica.
Journal of the Jamaica Agricultural Society.

BRITISH EAST AFRICA.

Department of Agriculture, Nairobi.
Leaflet No. 18. Tobacco.

UNITED STATES OF AMERICA.

United States Department of Agriculture.—Office of Experiment Stations.
Experiment Station Record, Vol. XVII., Nos. 10, 11, and 12 (June, July, and August, 1906). Vol. XVIII., No. 1 (September, 1906).

Agricultural Colleges and Experiment Stations.
Arizona.—Bulletin 53. Irrigating Sediments and their effects upon Crops.
California.—Bulletin 177. A New Method of Making Dry Red Wine.
Hawaii.—Press Bulletin No. 16. The Avocado Mealy-Bug.
Press Bulletin No. 17. The Mango Weevil.
Kansas.—Bulletin No. 136. Comprising Press Bulletins Nos. 125-151.
Bulletin 137. Variations in the Test of Separator Cream.
Bulletin No. 138. Effect of Bacteria in Wash Water of Butter.
Bulletin No. 139. The Study of Corn.
Michigan.—Bulletin No. 236. Spraying for Potato Blight in 1905.
Bulletin No. 237. Digester Tankage for Swine.
North Dakota.—Bulletin No. 70. Paints and their Compositions.
South Dakota.—Bulletin No. 97. Speltz and Millet for the Production of Baby Beef.
Texas.—Bulletin No. 84. Tomato Fertilizers at Troupe.
Virginia.—Bulletin No. 160. The Influence of Selected Yeasts upon Fermentation.
Bulletin No. 161. Varieties of Fruit for the Home Orchard.
Bulletin No. 162. Improving the Quality of Cream from Inferior Milk.
Wyoming.—Bulletin No. 70. Wyoming Forage Plants and their Chemical Composition.

Experiment Station of the Hawaiian Sugar Planters' Association.—Division of Agriculture and Chemistry.
Bulletin No. 17. Comparative Tests with varieties of Sugar Cane.
Bulletin No. 18. Hawaiian Waste Molasses.

S. W. WAGSTAFF,
Librarian.

GENERAL NOTICES.

LIST OF FARMERS' ASSOCIATIONS AND AGRICULTURAL SOCIETIES IN THE TRANSVAAL.

Aapjes River Ward Agricultural Society, A. F. von Gass, Pyramid Station.
Aapjes River Ward Farmers' Association, F. Carlyon, Pyramid Station.
Barberton Farmers' Association, Geo. E. O. Wilhelm, Box 157, Barberton.
Barberton Agricultural Society, J. S. Dyce, Box 5, Barberton.
Barberton and District Farmers' Association, G. E. O. Wilhelm, Secretary and Treasurer, Box 157, Barberton.
Bloemhof Agricultural Society, W. L. Dagg, Bloemhof.
Carolina Agricultural Society, M. van Enter, Box 43, Carolina.
Christiana Agricultural Society, Secretary, Christiana.
Crocodile River Farmers' Association, F. J. van Deventer, Box 751, Pretoria.
Eastern Transvaal Farmers' Association, T. W. Snaith, Box 75, Springs.
Ermelo Agricultural Society, A. Smuts, Box 5, Ermelo.
Elands River Farmers' Association, E. H. Eloff, Rietvlei, Lindley's Poort, Rustenburg.
Haenertsburg Farmers' Association, Haenertsburg, *via* Pietersburg.
Heidelberg Agricultural Society, W. Harvey, Box 36, Heidelberg.
Hekpoort Farmers' Association, Secretary, *via* Krugersdorp.
Hex River Farmers' Association, W. Breedt, Hex River, Rustenburg.
Highveld Farmers' Association, F. Findley, Ceylon, *via* Krugersdorp.
Highveld Farmers' Association, W. Robinson, Rustenburg.
Klerksdorp Agricultural Society, H. Bramley, Box 56, Klerksdorp.
Klip River Farmers' Association, Krugersdorp.
Koesterfontein Farmers' Association, Secretary, *via* Krugersdorp.
Krugersdorp Farmers' Association, G. Figulus, Box 188, Krugersdorp.
Krugersdorp Agricultural Society, H. A. von Blommestein, Box 368, Krugersdorp.
Lydenburg Agricultural Society, S. Hiemstra, Box 69, Lydenburg.
Lydenburg Farmers' Association, E. de Souza, Lydenburg.
Leuwdoorns Farmers' Association, W. Sterling Hamilton, Syfergat, Leuwdoorns, *via* Klerksdorp.
Marico Agricultural Society, J. L. van Heerden, Box 82, Zeerust.
Middelburg Agricultural Society, J. W. Henwood, Box 229, Middelburg.
New Scotland Farmers' Association, H. S. Parry, Grasdal, Lake Chrissie.
New Agatha Farmers' Association, R. F. Shirley, New Agatha, *via* Pietersburg.
Pietersburg Agricultural Society, J. W. Johnson, Box 32, Pietersburg.
Pietersburg Farmers' Association, G. G. Munnik, Pietersburg.
Pietersburg Poultry Club, H. Moore, Box 103, Pietersburg.
Piet Retief Farmers' Association, K. P. van Dijk, Box 18, Piet Retief.
Pisanghoek Farmers' Association, W. J. Brickhill, Diana, *via* Pietersburg.
Platrand Farmers' Association, A. H. Barron, Platrand.
Potchefstroom Agricultural Society, Secretary, Box 70, Potchefstroom.
Potgietersrust Fruitgrowers and Planters' Association, H. J Strobel.
Pretoria Agricultural Society, H. Cornforth, Box 685, Pretoria.
Rand Poultry Club, F. H. Stoll, Box 2712, Johannesburg.
Rustenburg Farmers' Association, Leo Machol, Rustenburg.
Settlers' Association, Hon. H. Wyndham, Kroomdraai.
Southern Waterberg Farmers' Association, C. M. Quarry, P.O, Warmbaths.
Standerton Agricultural Society, F. C. de Witt, Box 158, Standerton.
Transvaal Agricultural Union, F. T. Nicholson, Box 134, Pretoria.
Transvaal Farmers' Association, E. W. Hunt, Box 3785, Johannesburg.
Transvaal Land Owners' Association, H. A. Baily, Box 1281, Johannesburg.
Transvaal Poultry Club, J. F. Hilson, Box 1129, Pretoria.
Transvaal Stockbreeders' Association, F. T. Nicholson, Box 134, Pretoria.
Vaal River Farmers' Association, J. van Zijl, *via* Potchefstroom.
Waterberg Agricultural Society, I. von Backstroom, Box 7, Nylstroom.
Wakkerstroom Agricultural Society, G. Maasdorp, Volksrust.
Witfontein Farmers' Association, J. Krugel, *via* Krugersdorp.
Witwatersrand Farmers' Association, H. J. A. Wentworth, P.O. Craighall, near Joh'burg.
Witwatersrand Dairy Farmers' Association, H. Clarke, Box 5908, Johannesburg.

Witwatersrand Agricultural Society, W. H. Poultney, Box 4344, Johannesburg.
White River Farmers' Association, Archibald T. Ralls, White River, *via* Nelspruit.
Wolmaransstad Farmers' Association, F. W. Konig, Box 1, Wolmaransstad.
Wonderfontein Farmers' Association, Secretary, *via* Krugersdorp.
Woodbush Farmers' Association, Secretary and Treasurer, Percy Kent, Spitskop, P.O. Haenertsburg.
Zwartkop Farmers' Association, M. Vorster, Zwartkop, *via* Krugersdorp.
Zwartruggens Farmers' and Planters' Association, G. R. Wedderburn, J.P., Broadwood Vale, P.O. Kosterfontein, Rustenburg.

OTHER COLONIES.

Agricultural Union of Cape Colony, D. M. Brown, Box 187, Port Elizabeth.
Bloemfontein and O.R.C. Agricultural Society, J. Fraser, Box 250, Bloemfontein.
Cape Central Farmers' Association, H. C. Hall, Bedford, Cape Colony.
Cape Stud Breeders' Association, J. Pike, Box 703, Capetown.
Natal Agricultural Union, D. M. Eadie, Timber Street, Pietermaritzburg.
Orange River Colony Central Farmers' Association, W. B. Fowler, Secretary, Hill's Buildings, Maitland Street, Bloemfontein.
Orange River Colony Stockbreeders' Association, Secretary, Bloemfontein.
Rhodesian Agricultural Union, Secretary, Box 135, Salisbury, Rhodesia.
South African Co operative Union, A. C. Lyell, Box 574, Bloemfontein, O.R.C.
Upper Klip River Farmers' Association, Secretary, Vrede District, O.R.C.

* * *

PORTS FOR ENTRY OF STOCK.

The following are the ports for entry of stock into this Colony from the neighbouring territories:—

Mafeking Road Border	Cape Colony.
Mosimyani	"
Fourteen Streams	"
Coal Mine Drift	Orange River Colony.
Vereeniging	"
Roberts' Drift	"
Volksrust	Natal.
Komati Poort, through which stock not provided for under Clause 5, Government Notice No. 834 of 1903, will only be allowed to proceed by rail, to be examined at Machadodorp	Portuguese East Africa.

* * *

DISEASES OF STOCK.

(Government Notice No. 834 of 1903.)

1. In these Regulations the term "Stock" means cattle, sheep, goats, horses, mules, donkeys, and pigs.

2. The following diseases shall be considered contagious diseases for the purpose of these Regulations, and shall be dealt with as hereinafter directed. The list may be added to by Proclamation in the *Gazette*:—

(*a*) Rinderpest.
(*b*) Pleuro-pneumonia (or lung-sickness).
(*c*) Redwater and Rhodesian Redwater.
(*d*) Tuberculosis.
(*e*) Foot and Mouth Disease.
(*f*) Anthrax (or splenic fever).
(*g*) Glanders and Farcy.
(*h*) Scab in Sheep and Goats.
(*i*) Swine Fever.
(*j*) Swine Erysipelas.
(*k*) Mange (Scabies) in Horses and Mules.
(*l*) Ulcerative Lymphangitis.
(*m*) Sheep Pox.

AFRICAN COAST FEVER.

Amended Proclamation of the Cape Colony.

By Proclamation No. 231 of July 22nd, 1904, the provisions of Proclamation No. 202 of June 29th, 1904, are amended as follows:—

Dogs and cats will be admitted with special permission of the Chief Veterinary Surgeon, or his authorised representative, provided they are accompanied by a certificate signed by the Principal Veterinary Surgeon of the Transvaal, or his authorised representative, to the effect that they have not come from or passed through any portion of the Transvaal proclaimed or known to be infected with African Coast Fever.

* * *

SWINE FEVER.—WITWATERSRAND.

The outbreak of Swine Fever in the Witwatersrand District having been stamped out, the Government Notice declaring the said area infected has been cancelled. It is, therefore, no longer necessary to obtain permits to move pigs into or out of the Witwatersrand District.

* * *

GOVERNMENT NOTICE No. 103 of 1907.

It is hereby notified for public information that compensation will be paid for visibly healthy equines which, when the mallein test is applied to them by an authorised person of the Agricultural Department, react to such test, and are afterwards destroyed by order of the Principal Veterinary Surgeon in consequence of their having so reacted.

Provided that:—

(a) The owner or custodian of any such reacting animal has given notice in writing before the premises on which the animal is located are visited by an Officer of the Agricultural Department, to the Government Veterinary Surgeon of the District, that he suspects such animal to be infected with Glanders; and

(b) Such Government Veterinary Surgeon has certified to the fact and date of such notice; and

(c) Such animal has not at any time shown outward signs of being infected with Glanders.

No compensation will be paid on a greater scale than two thirds of the value of the animal destroyed, and in no case will a greater sum than £20 be paid for any animal destroyed as aforesaid. The value of any animal destroyed will be determined by the Principal Veterinary Surgeon.

Compensation will not be paid for any animals showing any clinical indication of Glanders which are ordered to be destroyed by the Principal Veterinary Surgeon, or by any person acting on his instructions, nor for any reacting animal ordered to be destroyed in respect of which the above conditions are not complied with.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 24th January, 1907.

* * *

GLANDERS AND FARCY.

Warning to the Public.

A considerable number of outbreaks of Glanders having been reported to the Agricultural Department as having occurred in various districts of the Colony during the past few weeks, the public are warned against the purchase of equines from unknown travelling dealers or on auction sales, unless the animals put up for sale are sold with a written guarantee signed by the owner, certifying that they are free from any contagious disease as there is no doubt that unscrupulous persons have lately been disposing of infected animals at prices which have tempted the public to purchase the same, and that the disease has subsequently appeared in the stables of purchasers to their loss and detriment.

It is further recommended that all newly purchased equines should be kept isolated and should be watered separately and apart from any other equines on the premises for a period of three weeks after purchase, and should they show any indications suspicious of Glanders, a report should be forwarded at once to the Government Veterinary Surgeon of the District.

The following description of the disease is appended for the information of the public, and special attention is called to Government Notice No. 103 of 1907, which appears underneath.

Glanders and Farcy.

These two names are applied to one and the same disease, which is due to a microbe—Bacillus Malleus. The disease is called Farcy when located on the limbs or body; Glanders when the principal symptoms are seen in the nostrils, submaxillary glands, and lungs.

The horse tribe is most commonly affected with Glanders. Man not infrequently gets the disease from the horse by inoculation through a wound. The dog, the cat, and wild carnivora may be infected. The ox is absolutely immune. Sheep, goats, and pigs are immune for all practical purposes.

A horse may be affected with Glanders and show no symptoms except slight unthriftiness. This is called occult Glanders, and can only be diagnosed by the mallein test.

In typical clinical cases there is a thick grey-coloured discharge from one or both nostrils. Ulcers and ulcerous patches are seen inside the nasal cavities and the glands under the jaw are enlarged and hard. The temperature may be raised, but in chronic cases it may be no higher than the normal. In severe and acute cases the temperature is several degrees above normal and the animal shows distinct symptoms of respiratory disease. In Farcy one or more limbs become swollen. The lymph vessels stand out prominently on the inside of the limbs. The vessels give a cord-like feel to the hand, and small nodules appear along the course of the vessels. These nodules become ulcers which discharge a thick yellow fluid of oily appearance. The ulcers may heal and leave a scar, but they usually break out again. Farcy may also appear on the skin of the neck and body.

One sees the ulcers on the skin if Farcy has been present. Besides what one sees in the live animals, one may also find ulceration of the throat and air passages. The most constant changes are found in the lungs. In acute Glanders, small grey nodules about the size of a pin-head are seen all through the lung substance. In the chronic forms the nodules in the earlier stages appear as small grey patches with a red margin. Others are of pus-like consistence. The older nodules are hard and shot-like to the touch; some of them are gritty—calcification. The number of nodules in a lung varies from one or two to hundreds. The donkey suffers from an acute form of Glanders in which the lungs are inflamed over a large surface. The tissue is solid, and on section the surface of the lung has a greyish red colour.

* * *

GOVERNMENT NOTICE No. 31 of 1907.

Under and by virtue of the powers in him vested by section *four* of the Diseases of Stock Ordinance, 1902, His Excellency the Acting Lieutenant-Governor has been pleased to prohibit, until further notice, the importation of Cattle from the Colony of Natal into this Colony, with the exception of stock entering under permit from oversea and passing through Natal by rail direct; provided that notwithstanding such prohibition, slaughter cattle for which permits have at the date of this notice been issued under Regulation 8 of the Regulations published under Government Notice 1288 of 1906, shall be admitted subject to the terms of such regulations.

Government Notice No. 1287 of 1906 shall be and is hereby withdrawn.

By Command of His Excellency the Acting Lieutenant-Governor.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 9th January, 1907.

* * *

GOVERNMENT NOTICE No. 32 of 1907.

His Excellency the Acting Lieutenant-Governor has been pleased to repeal the regulations published under Government Notice 1288 of 1906, and to substitute the following therefor :—

1. Any person who shall import any cattle from the Colony of Natal into this Colony, save cattle entering under permit from oversea and passing through Natal by rail direct, shall be liable, on conviction, to a fine not exceeding £50, and, in default of payment, to imprisonment, with or without hard labour, for a period not exceeding six months.
2. Any cattle which may, after the date of the promulgation of these regulations, have come into this Colony from the Colony of Natal, save as is excepted in the preceding regulation, and save such slaughter cattle for which permits have at the date of this notice been issued, may be seized by any Resident Magistrate, Native Commissioner, Sub Commissioner, Justice of the Peace, Police Officer, or Constable, and detained and taken to a place of isolation, and the person so seizing and detaining such cattle shall immediately report all the circumstances to the Commissioner of Lands, who may order any such cattle to be slaughtered or otherwise dealt with.

By Command of His Excellency the Acting Lieutenant-Governor.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 9th January, 1907.

MADAGASCAR CATTLE.

His Majesty's Consul at Antananarivo has notified His Excellency the High Commissioner that the Export Duty on bullocks from Madagascar has been reduced from twelve shillings to two shillings per head.

* * *

AN ORDINANCE (No. 3 of 1906) TO IMPOSE A DUTY ON THE EXPORT OF ANGORA RAMS AND EWES.

Be it enacted by the Lieutenant Governor of the Transvaal with the advice and consent of the Legislative Council thereof as follows:—

1. Upon every Angora ram or ewe exported from this Colony after the date of the taking effect of this Ordinance there shall be payable save as herein provided to the officer appointed to receive the same a duty of one hundred pounds; provided always that no such duty shall be payable on the export of any such ram or ewe to any Colony or Territory in South Africa as soon as the Lieutenant-Governor shall by proclamation declare that such Colony or Territory has by statute provided for the imposition of a duty on the export of Angora rams and ewes not less than the amount imposed by this Ordinance.

2. Every person who shall export from this Colony any Angora ram or ewe (save as in this Ordinance provided) without payment of the duty imposed thereby shall be liable on conviction in addition to the duty to a fine of not less than twenty five pounds and not exceeding one hundred pounds for every such ram or ewe so exported, and in default of payment to imprisonment with or without hard labour for a period of not less than one month and not exceeding six months unless such fine be sooner paid.

3. Courts of Resident Magistrate shall have special jurisdiction to impose any of the penalties provided by this Ordinance for a contravention hereof.

4. It shall be lawful for the Lieutenant-Governor from time to time to make regulations for carrying out the provisions of this Ordinance.

5. This Ordinance may be cited for all purposes as the Angora Export Duty Ordinance, 1906.

Passed in Council the twenty-eighth day of June, One thousand Nine hundred and Six.

* * *

DESTRUCTION OF VERMIN.

The following regulation (Section D of Government Notice No. 1341 of 1906) is published for general information:—

(D.)—Vermin.

16. The animals named in Schedule F hereto shall be deemed to be vermin, and rewards for the destruction of them shall be paid at the rates shown in the Schedule by the Resident Magistrate of the district in which they are destroyed.

17. Vermin may be destroyed by shooting, coursing, by means of nets, springes, gins, traps, snares, or by poison, provided that when poison is used for the destruction its use shall be subject to such conditions as the Resident Magistrate of the district may prescribe, and provided that no poison may be used during the open season.

18. In proof of the destruction of vermin the applicant for reward will be required to produce in the case of lion, leopard, cheetah, lynx, serval cat, civet cat, Kaffir cat, genet cat, silver jackal, and red jackal the skin with the tail not severed; and in the case of wild dog, hyena, and baboon the head; and will also be required to make a written declaration in the form given in Schedule G hereto.

19. The skins of vermin for the destruction of which reward has been paid shall be the property of the Government, and shall, if in good condition be marked by the official before whom they are produced at the juncture of the tail with the skin of the body with a perforating stamp, or in such other way as the Colonial Secretary may from time to time prescribe, and thereafter be sold by the Resident Magistrate by public auction or disposed of in such other way as he may consider to be best in the interests of the Government. The proceeds of such sale or disposal shall be paid into Revenue.

Skins not in good condition and heads shall be destroyed.

20. Any person who secures or attempts to secure for himself or any other person a reward for the destruction of vermin by means of a false declaration or by the production of skins or heads belonging to vermin, for the destruction of which a reward has already been paid, shall be liable on conviction to a fine not exceeding £10 for every head of vermin for which he has secured or attempted to secure such reward.

Schedule F.

	£	s.	d.
Wild Dog	1	0	0
Silver Jackal	0	2	6
Red Jackal	0	5	0
Baboon	0	2	6

SCHEDULE G.

I, ...
hereby declare that the following animals :—
....
....
....
....
have been destroyed by me within the official boundaries of the..........................
District, and that the skins and tails (or heads) I have produced to the Resident Magistrate actually belonged to such animals.

* * *

REGULATIONS AND CONDITIONS FOR THE HIRE OF A GOVERNMENT WATER DRILL FOR BORING FOR WATER.

1.—SUBMISSION OF APPLICATION.

Applications by farmers for the hire of a Government Water Drill for boring for water should be sent on form $\frac{\text{I. D.}}{\text{B.}}$, No. 49 (Revised), to the Boring Engineer, Irrigation Department, P.O. Box 557, Pretoria, through the Resident Magistrate of the district in which the applicant resides.

* * *

GOVERNMENT NOTICE No. 522 OF 1906.

Under and by virtue of the powers in him vested by Section 4 of the Diseases of Stock Ordinance of 1902, His Excellency the Acting Lieutenant-Governor has been pleased to prohibit, until further notice, the importation of cattle from the Colony of Natal, with the exception of

(1) Stock entering under permit from oversea and passing through Natal by rail;
(2) Slaughter stock travelling direct by rail under permit to any enclosure approved by the Government Veterinary Department for the reception of such slaughter stock.

By Command of His Excellency the Acting Lieutenant-Governor.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands.
Pretoria, 25th May, 1906.

* * *

GOVERNMENT NOTICE No. 523 OF 1906.

His Excellency the Acting Lieutenant-Governor has been pleased to make the following regulation under Section 5 of the Diseases of Stock Ordinance of 1902 :—

Any person who shall import or cause to be imported any stock into this Colony in contravention of the terms of Government Notice No. 522 of 1906, or who shall remove any stock alive from any enclosure therein mentioned, shall be liable upon conviction to a penalty not exceeding Fifty Pounds, and in default of payment of the same to imprisonment with or without hard labour for a period not exceeding six months.

Any cattle introduced without such permit as is mentioned in the said Government Notice may be slaughtered by order of the Commissioner of Lands, or dealt with in whatever manner the Commissioner may prescribe.

By Command of His Excellency the Acting Lieutenant-Governor.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 25th May, 1906.

* * *

RABIES IN RHODESIA.

The Secretary for Agriculture writes as follows :—

The disease is increasing. The last outbreak in a previously non-infected area occurred at a farm in the Enterprise District, about 25 miles from Salisbury, on 25th ultimo. Within the past six months one European and two natives have died of hydrophobia. The nearest reported case to the Transvaal border during the past twelve months occurred near the township of Gwanda.

Steps are now being taken to have all dogs in the country registered, and it is hoped by this means to reduce the number of native owned dogs, which are regarded as the chief cause of the spread of the disease, and to trace the source of any outbreak, so that the number of dogs in the district of origin may, if necessary, be destroyed.

TRANSVAAL INDIGENCY COMMISSION.

1. To enquire and report whether conditions of indigency exist among persons of European nationality in the Transvaal such as to require remedial measures.

2. To consider the origin and effect of such conditions,
   (a) as affecting persons born in South Africa;
   (b) as affecting persons who have immigrated from other countries.

3. To enquire and report as to the cause of such conditions and, in particular, how far they arise from any or all of the following causes—
   (a) general economic conditions, whether temporary or permanent;
   (b) the operation of particular laws or customs, especially those relating to the tenure and transmission of landed property;
   (c) deficiencies in training or education.

4. To enquire and report what measures should be taken, if any, for the abatement of the evil, and more particularly to advise how far those measures should be taken by the Government, how far by Local Authorities, and how far by private agencies; and to what extent, in the last two cases, Local Authorities or private agencies should be subsidised and controlled by the Government.

5. To enquire into the control of public orphanages, and to advise whether they should be managed and paid for by the Government, and, if not, whether they should be managed and paid for by Local Authorities or private societies, and, if so, how far it is desirable that such Local Authorities or private societies should be subsidised by the Government.

The members are:—

John William Quinn (*Chairman*), General Louis Botha, Hugh Crawford, Richard Feetham, Johan Rissik, Frank Braybrooke Smith (*Director of Agriculture*).

Mr. Philip Henry Kerr, Assistant Secretary to the Inter-Colonial Council, has been appointed Secretary to the Commission.

* * *

GOVERNMENT NOTICE No. 231 OF 1907.

The following is published for general information.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 8th February, 1907.

It is hereby notified for general information that the undermentioned brands have been duly allotted and registered under the Great Stock Brands Ordinance (Ordinance No. 15 of 1904) during the quarter ending 31st December, 1906.

F. B. SMITH,
Director of Agriculture.

Pretoria,
8th February, 1907.

No. of Brand	Name of Owner.	Address.	District.	Brand.
332	South Geldenhuis Deep, Ltd.	P.O. Box 178, Germiston	Witwatersrand	XS4
333	Boksburg Municipal Pound	P.O. Box 85, Boksburg	,,	◊X4
334	Turner, Walter Henry	Daggafontein 94/175, P.O. Box 59, Springs (Boksburg District)	,,	X71
335	Faure, Jan Pieter Hendrik	Vlakhoek 218, P.O. Vlakhoek, *via* Krugersdorp	Rustenburg	R1F
336	Villiers, de, Peter Wouter	Wolmaransstad, P.O. Wolmaransstad, *via* Krugersdorp	Wolmaransstad	V1V
337	Potgieter, Carl Sebastian	Warmbaths	Waterberg	WP6
338	Stump, Henry Richard	Kareepan, P.O. Doyleton, *via* Taungs	Bloemhof	B0X
339	Bohme, Emil Ernest Gottfried	Vechtvallei, P.O. Abelskop, *via* Schweizer Reneke	,,	BE1

No. of Brand.	Name of Owner.	Address.	District.	Brand.
340	Conradie, Frans Daniel	De la Reyspan, P.O. Doyleton, *via* Taungs	Bloemhof	BF1
341	Forbes, Harry	Grootpoort, P.O. Schweizer Reneke, *via* Bloemhof	,,	B2F
342	Ruddle, James Skeate	Geluk, P.O. Schweizer Reneke	,,	BJ7
343	Lange, de, Johannes Jacobus	Damplaats, P.O. Schweizer Reneke	,,	B2D
344	Lock, Hendrik Willem	Marootjesfontein. P.O. Schweizer Reneke	,,	B1L
345	Jelliman, William Kibble	Niekerksrust, P.O. Schweizer Reneke	,,	BJ8
346	Kotzee, Hermanus Egbert Pieter	Kleindoorns, P.O. Schweizer Reneke	,,	B1H
347	Cloete, William Isaac	Honey's Kop, P.O. Doyleton, *via* Taungs	,,	BC2
348	Merwe, van der, Jacob Francois	Naaupoort, P.O. Doyleton, *via* Taungs	,,	B2J
349	Merwe, van der, Willem Johannes Isaac	Italie, P.O. Doyleton, *via* Taungs	,,	BV8
350	Beer, de, Johan Mathys Adam	Fort Weber. P.O. Doyleton, *via* Taungs	,,	BD2
351	Schucke, Johan Frederik	Vechtvallei, P.O. Doyleton, *via* Taungs	,,	BS1
352	Reyneke (P.'s son), Jacobus Cornelis	Rietput 20, P.O. Schweizer Reneke	,,	BJ2
353	McLitchie, Thomas	Caledonia, P.O. Schweizer Reneke	,,	B1M
354	Doyle, William Jeremiah	P.O. Doyleton, *via* Taungs	,,	B7D
355	Tarlton, Fritz Ernest	Weltevrede, P.O. Kareepan	,,	BT3
356	Beveridge, Walter Joseph Paterson	Schoorspruit, P.O. Bloemhof	,,	B0B
357	Evans, Herbert Morgan	Elandsfontein 360, P.O. Box 225, Potchefstroom	Potchefstroom	PE6
358	Curlewis, James Frederick Inglis	P.O. Box 186, Potchefstroom	,,	PC0
359	Abrams, Kate (Mrs.)	Albion Hotel, Jamestown	Barberton	NM5
360	Tidboald and White (Tidboald, Albert Edward; White, William Henry)	P.O. Springbokflats, *via* Warmbaths	Waterberg	WT2
361	Esakov, Salamon	Witbank, P.O. Witbank	Middelburg	GE1
362	Bilbings, Arthur	Warmbaths, P.O. Warmbaths	Waterberg	WB4
363	Winkler, Karl	Helderfontein, P.O. Box 21, Pietersburg	,,	WK4
364	Foskett, Arthur John	Palmietfontein, P.O. Box 192, Heidelberg	Heidelberg	HF4
365	Davidson & Holgate (Davidson, David, and Holgate, John Biddlecomb)	Wilde als Kraal, *via* Balfour	,,	HD2
366	Hansen, Johannes	P.O. Rooijantjesfontein	Lichtenburg	LH4
367	Badenhorst, Dirk Cornelius Petrus	Palmietfontein No. 86, P.O. Hauptsrust	,,	LB7
368	Badenhorst, Casper Hendrik	Palmietfontein No. 86, P.O. Hauptsrust	,,	L1B
369	Thompson, Robert	One Tree, P.O. Box 125, Krugersdorp	Krugersdorp	KT1
370	Biggs, Robert Chapman	Rietspruit, P.O. Box 122, Middelburg	Middelburg	G5B
371	Amoils Brothers (Partners: Isaac Amoils, Edel Amoils, Abraham Amoils and Moses Amoils)	Corner of Pine Avenue and Park Road, Fordsburg, P.O. Box 4808, Johannesburg	Johannesburg	JA5

No. of Brand.	Name of Owner.	Address.	District.	Brand.
372	Moolman, Petrus Lafras	Mooiplaats No. 97, P.O. Box 101, Ermelo	Ermelo	EM7
373	Button, James; Gerrie, James Andrew	Groot Geluk, P.O. Godwan River Station	Barberton	NB2
374	Matlabi, Joel (Native)	Rietfontein, P.O. Mabalstad	Rustenburg	R2M
375	Joubert, Petrus Jacobus	Boschkop, P.O. Box 111, Pretoria	Pretoria	AJ1
376	Hebler, Willelm	Hamanskraal, P.O. Hamanskraal	,,	A0H
377	Wilson, William Edmond	Klippan No. 446 and Scheerpoort, P.O. Box 366, Pretoria	,,	AW0
378	Behr Brothers (Behr, Haman Abram, and Behr, Moses)	Bulfontein No. 102, P.O. Rhenosterkop	,,	AB3
379	Pretoria Suburbs Health Committee	C/o Resident Magistrate's Office	,,	AH8
380	Ramushue, Zachariah	Zandfontein No. 155, c/o Sub-Native Commissioner, P.O. Warmbaths	Waterberg	WZ1
381	Bendigo	Oudhoutspruit No. 117, P.O. Val	Standerton	SA3
382	Amm, Louisa Elizabeth	Rietfontein No. 503, P.O. Box 22, Potchefstroom	Potchefstroom	P0A
383	McDougall, Samuel	Brooklands Farm, P.O. Holmdene	Standerton	S2M
384	Henrico, Hendrik Salidor	Schoongezicht 144, P.O. Hamanskraal	Pretoria	A5H
385	Hall, Henry Thomas	Tiegothnan, P.O. Pyramids Station	,,	AH4
386	Meintjes, Edward Philip Arnold	Strydfontein, P.O. Box 161, Pretoria	,,	A8A
387	Rensburg, van, Willem Jacobus Janse	Witpoort No. 71, P.O. Wolmaransstad	Wolmaransstad	V5Y
388	Eastern Transvaal Plantations, Ltd.	Singerton, *via* Hectorspruit Railway Station	Barberton	NS0
389	Rogers & Fairclough	Kareebosch 88, P.O Box 103, Standerton	Standerton	SX7
390	Jooste, Robert Johannes	Rietfontein 632, Box 163, Klerksdorp	Potchefstroom	P1J
391	McCord, James John	Roodepoort 2148, P.O. Warmbaths	Waterberg	WM4
392	Gaarkeuken, Simon	Middelfontein, P.O. Louwbad	,,	WG5
393	Brink, Johannes Hieronimus	Naudesbank 224, P.O. Carolina	Carolina	CB1
394	Pollett, Ralph	Noodshulp, P.O. Warmbaths	Waterberg	WP7
395	Phelta, Fillman (Native)	Marabastad Location, Pretoria	Pretoria	AF4
396	Schulenburg, Chrisoph Ernst	P.O. Rooijantjesfontein	Lichtenburg	L2S
397	Attwell, Charles Lennox; Attwell, Henry Percival; Attwell, Kimberly Cecil Lennox; Attwell, Frederic William; Attwell, Purden Edwin Stretch	Pleizier, P.O. Biesjesvlei	,,	L1A
398	Wronsky, Maude	Boschpan 274	,,	L5W
399	Badenhorst, Tobias Johannes Matthys	Palmietfontein 86, P.O. Hauptsrust	,,	L7B
400	Lichtenburg Municipality	P.O. Box 7, Lichtenburg	,,	L0M
401	Randfontein Estates, Ltd.	Randfontein	Krugersdorp	KB0
402	Reid, John Ormiston	Misgund, Van Wyks Rust, P.O. 802, Johannesburg	,,	KR2
403	Haasbroek, Zarel Francois	Blinkklip, P.O. Leeuwdoorns	Wolmaransstad	VH1

No. of Brand.	Name of Owner.	Address.	District.	Brand.
404	Coetzee, Hendrik Schalk	Bospan, P.O. Leeuwdoorns	Wolmaransstad	VC1
405	Roos, Carl Peter John	Palmietfontein, P.O. Bosmansrust	,,	V2C
406	Vuuren, van, Lucas Rudolphus Jan, sen.	Jackhalsfontein, P.O. Zendlingsfontein	,,	VX1
407	Minter, John Clarence; Minter, Thomas Leonard	P.O. Wakkerstroom	Wakkerstroom	UC3
408	Clouston, James Malcolm	P.O. Box 82, Volksrust	,,	UC1
409	Niekerk, van, Schalk Willem	Vlakfontein 133, Box 71, Ermelo	Ermelo	EN1
410	Lewis, Bernard	Rietfontein 940, P.O. Warmbaths	Rustenburg	RL7
411	Bateman, Charles Cecil	Kalkpan No. 1462, P.O. Box 129, Pietersburg	Waterberg	WB0
412	Shepherd, James	P.O. Box 127, Boksburg	Witwatersrand	XS7
413	The Anglian Mining & Finance Co. (A. J. Thatcher)	P.O. Box 3888, Johannesburg	Krugersdorp	KA1
414	Campbell, William	P.O. Box 22, Klerksdorp	Potchefstroom	P1C
415	Fryer, John Ernest	P.O. Box 4, Klerksdorp	,,	P3F
416	Gluckman, Jacob	Thyszyndoorns, P.O. Frederikstad	,,	PG7
417	Schlosberg & Slesing (Schlosberg, Scheftel, & Slesing, Philip)	P.O. Box 36, Nylstroom	Waterberg	WS0
418	Wilson, Henry	Hendrikspan, Bethal, Box 5859, Johannesburg	Bethal	TH3
419	Badenhorst, Petrus Johannes Cornelis	Nooitgedacht 60, P.O. Davel	Ermelo	EB3
420	Coe, Richard James	Jonkersprnit, P.O. Box 77, Standerton	Standerton	SC2
421	The Rand Cold Storage Co., Ltd.	Standerton	,,	S0W
422	Naude, Sarel Hendrik Jacobus	Nooitgedacht 205, P.O. Doyleton, via Taungs	Bloemhof	B3S
423	Banger, Evan Lillington, and Byerley, Christian	Marite 253, P.O. Bushbuck Ridge	Lydenburg	Y2B
424	Lombard, Anthony Christoffel	Slypsteen, P.O. Hauptsrust	Lichtenburg	L2L
425	Swanepoel, David Jacobus	Baviaanskrans, P.O. Leeuwdoorns	Wolmaransstad	VS1
426	Reed, Joseph	P.O. Wolmaransstad	,,	V2R
427	Badenhorst, Jacobus Marthinus Steyn	Hartebeestfontein 624, P.O. Hartebeestfontein	Potchefstroom	PB8
428	Cronje, Andries Petrus Johannes	Palmietfontein 271, P.O. Klerksdorp	,,	PC4
429	Geyser, Andries Hermanus	Erf 442, Rabie Street, Potgietersrust	Waterberg	WA2
430	Pretorius, Hercules Albertus	Broederstroom, c/o John Jack (East), Pretoria	Pretoria	AP4
431	Schnitter, Otto Gottlob	Hex River, P.O. Greylingstad	Heidelberg	HX2
432	Rhenosterfontein Pound	P.O. Ventersdorp	Potchefstroom	◊ P4
433	Ventersdorp Pound	P.O. Ventersdorp	,,	◊ P8
434	Reynolds, Herbert John	Bloemhof, P.O. Bloemhof	Wolmaransstad	VR4
435	Thomas, William Henry	Farm Thornhill, P.O. Maquassi, P.O. Box 1960, Joh'burg	,,	V7T
436	Cusack, Joseph Michael	Murrumbidgee, P.O. Maquassi Station	,,	VC4
437	Bowman Brothers	Farm Verblyding 44, P.O. Box 97, Standerton	Standerton	SB2
438	Geldenhuys, Elias Jacobus	Kruger Street, Potgietersrust	Waterberg	WE2
439	Pienaar, Johannes Jacobus	Erf 541, Brooklyn, P.O. Box 434, Pretoria	Pretoria	AP1

No. of Brand.	Name of Owner.	Address.	District.	Brand.
440	Basson, Stephanus Sebastian	P.O. Box 81, Pietersburg	Zoutpansberg	ZB2
441	Boltman, Jacob Cornelis	Korthani, P.O. Duivelskloof	,,	ZC7
442	Strachan Margaret Douglas	P.O. New Agatha	,,	Z7D
443	Edwards, Howell Tuberville	Welgeboschfontein 212, P.O. Pietersburg	,,	Z1E
444	Fogwill, Aylwith Rust	Mooiplaats, P.O. Louis Trichardt	,,	ZF1
445	Botha, Frederick Jan Hendrik Botha, Frans Johannes Botha, Nelis Gerhardus Petrus	Hansfontein, P.O. Duivelskloof Smitsrust, P.O. Duivelskloof Doornhoek, P.O. Duivelskloof	,,	ZF2
446	Ferreira, Frederick Charles	Mooiplaats, P.O. Duivelskloof	,,	Z4F
447	Grobler, Petrus Cornelius	Pisanghoek, P.O. Louis Trichardt	,,	ZG1
448	Goosen, Pieter Johannes	Rietbokfontein, P.O. Louis Trichardt	,,	ZG0
449	Gadd, John Edwin Wood	Klaarwater, P.O. Dwars River	,,	Z1G
450	Gerricke, Johan Godfried	Louis Trichardt	,,	Z2G
451	Geyser, Lucas Cornelius	Turffontein, P.O. Marabastad	,,	Z7G
452	Helberg, Gerhardus Johannes Zacharias	Hollandsdrift, P.O. Marabastad	,,	ZH7
453	Whipp, Harry	Ehlatini, P.O. New Agatha	,,	Z7H
454	Rensburg, van, Josephus Nicolas Janse	Rietvlei, P.O. Doornboom	,,	ZJ1
455	Preez, du, Johannes Lodewicus Hermanus	Rhenosterpoort, P.O. Klipdam	,,	ZJ2
456	Moulder James Edward, jun.	Palmietfontein 219, P.O. Pietersburg	,,	Z1J
457	Cooper, John Hendrik	Municipal Compound, Pietersburg	,,	Z7J
458	Alberts, Louis Jeremias Cornelis	Driekop, P.O. Haenertsburg	,,	ZL2
459	Lindenberg, Louis Phillip	Annadale, P.O. Pietersburg	,,	ZL7
460	Lombard, Stephanus Petrus	Klipspruit, P.O. Haenertsburg	,,	Z2L
461	Labuschagne, Frederick Johannes Willem Jacobus	Free State, P.O. Duivelskloof	,,	Z7L
462	McDonald, Willem Abbott	Vrischgewaagd, P.O. Duivelskloof	,,	ZM7
463	Demeyer, Floris Petrus Jacobus	Stirling, P.O. Louis Trichardt	,,	Z7M
464	Neethling, Hendrik Ludolph	Lot 36, P.O. Haenertsburg	,,	ZN1
465	Bezuidenhout, Petrus Jeremias	Vleurfontein, P.O. Louis Trichardt	,,	ZP2
466	Marx, Petrus Johannes	Schoongezicht, P.O. Doornboom	,,	ZP5
467	Ross, Thomas	The Grange, P.O. Dwars River	,,	Z1R
468	Smit, Petrus Johannes	Pisanghoek, P.O. Louis Trichhardt	,,	ZS1
469	Steynberg, Willem Frederick	Braksloot, P.O. Pietersburg	,,	ZS2
470	Stoltz, Okert Johannes	Basson, P.O. New Agatha	,,	ZS7
471	Bezuidenhout, Jacobus Stephanus	Fleurfontein, P.O. Louis Trichardt	,,	Z1S
472	Schiel, Fritz Georg Karl	Hillside, P.O. Louis Trichardt	,,	Z2S
473	Steynekamp, Gerhardus Petrus	Hollandsdrift, P.O. Marabastad	,,	Z4S
474	Smith, Andries Stephanus	Rietfontein, 578, P.O. Haenertsburg	,,	Z7S
475	Blanche, de, John Marcus	Matok, P.O. Dwars River	,,	Z1T

No. of Brand.	Name of Owner.	Address.	District.	Brand.
476	Thorpe, John, and Crighton, William Allan	Gelege Valley, P.O. Louis Trichardt	Zoutpansberg	Z6T
477	Vogel, Philip Lodewyk	Koedoeskop 255, P.O. Malipsdrift	„	ZV2
478	Vermaak, Adriaan Charles	P.O. Box 25, Pietersburg	„	ZV4
479	Riet, van der, Alfred John Verently	P.O. Louis Trichardt	„	ZV7
480	Viljoen, Willem Johannes	P.O. Duivelskloof	„	Z1V
481	Vorster, Ben	P.O. Box 75, Pietersburg	„	Z7V
482	Molyneux, Henry Walter	Mamatola, P.O. New Agatha	„	Z1X
483	Parnell, Dr. Peter	P.O. Haenertsburg	„	Z1P
484	Pittendrigh, Alexander	Clova, P.O. Spelonken	„	Z2P
485	Kriel, Jacobus Petrus	Radyn, P.O. Kalkbank	„	Z7K
486	Munnik, George Glaeser	P.O. Pietersburg	„	ZM3
489	Smith, Thomas Herbert	Grootfontein 152, P.O. Box 1180, Johannesburg	Heidelberg	HS3

Native Location Brands Allotted and Registered in Accordance with Section 16 of the Great Stock Brands Ordinance of 1904.

No. of Brand.	Name of Owner.	Address.	District.	Brand.
39	Sjambok's Location	C/o Sub-Native Commissioner, Pretoria	Pretoria	†S4
40	N'Kilikitlane Location	C/o Sub-Native Commissioner, Potgietersrust	Waterberg	†N4

Brands Surrendered and Cancelled in Terms of Sections 13 and 15 of the Great Stock Brands Ordinance of 1904.

No. of Brand.	Name of Owner.	Address.	District.	Brand.
149	Lombard, Johannes Petrus Legrange	Leeuwfontein 569, P.O. Wonderfontein	Middelburg	GA1
325	Houtpoort Pound	P.O. Heidelberg	Heidelberg	♢ H3
539	Zandfontein Pound	Zandfontein, P.O. Larcheny Siding	Standerton	♢ S4
	Bank Station Pound	Bank Station	Krugersdorp	♢ K3
486/06 487/06	Hekpoort Pound	Hekpoort	„	K6

TRANSVAAL METEOROLOGICAL DEPARTMENT.

RAINFALL RETURNS FOR THE MONTHS OF DECEMBER, 1906, AND JANUARY, 1907.

NOTE.—The rainy season is measured from 1st July in one year to the 30th June in the next.

DECEMBER, 1906.

District.	Place.	Month. Dec., 1906. Ins.	Month. Dec., 1906. Days.	Season. From 1st July, 1906. Ins.	Season. From 1st July, 1906. Days.
Barberton	Barberton	5·50	15	17·20	45
	Komati Poort	13·68	14	24·73	41
Bethal	Bethal	4·97	15	14·65	44
Bloemhof	Bloemhof	3·15	10	7·60	33
Carolina	Machadodorp	7·85	15	16·26	51
Ermelo	Ermelo	4·55	16	16·96	49
Heidelberg	Heidelberg	4 55	13	11·67	34
	Vereeniging	2·68	14	9 25	39
Lichtenburg	Lichtenburg	2·86	11	7·30	31
Lydenburg	Belfast	8·12	17	16·39	50
	Pilgrims Rest	3·30	18	13·72	60
Marico	Zeerust	3·25	10	14·36	33
Middelburg	Middelburg	4·54	16	16·80	52
Piet Retief	Piet Retief	4·57	7	22·76	37
Potchefstroom	Potchefstroom	3·79	14	10·12	36
	Klerksdorp	4·18	10	9·89	33
Pretoria	Arcadia, Pretoria	4·68	17	13·55	43
	Modderfontein	4 95	15	13 96	38
Rustenburg	Wolhuter's Kop	2·72	12	12·31	35
Standerton	Stud Farm	3·62	13	13·68	37
Swaziland	Mbabane	6·94	15	22·58	60
Wakkerstroom	Volksrust	5·46	16	18·31	49
Waterberg	Nylstroom	6·98	13	15·42	29
	Potgietersrust	10·74	16	19·48	40
Witwatersrand	Krugersdorp..	4·54	15	12·43	41
	Joubert Park, Johannesburg	5·20	15	16·44	40
	Government Observatory	4·59	16	15·41	41
	Zuurbekom	4·29	14	10·63	41
Wolmaransstad	Wolmaransstad	3·20	9	6·60	28
Zoutpansberg	Leydsdorp	6·97	13	14·91	23
	Louis Trichardt	6·30	—	21·46	—
	Hospital, Pietersburg ..	8·40	15	14·75	40

SUMMARY.—The rainfall in December has generally been over the average, both as to quantity and number of rainy days, but along the Vaal Watershed it has not been so plentiful, and there the month can only be considered passable. At Pretoria the season's rainfall (six months) is two inches over the average; at Johannesburg, five inches; and at Klerksdorp, three inches; but at Vereeniging it is half an inch under the average. Whilst some farmers are longing for more rain, the general wish is for more sunshine and warmer weather.

Some very heavy rainfalls have been recorded during the month in the Zoutpansberg District; at Sibasa 16·78 inches fell (including 7·21 inches on the 26th).

OBSERVERS' WEATHER REPORTS FOR DECEMBER, 1906.

BARBERTON DISTRICT.—

Barberton.—The month has been noteworthy for the continuous cloud that has covered the valley.—(J. B. Drake.)

BLOEMHOF DISTRICT.—

Bloemhof.—Although there were many signs of rain during the month, with much thunder, very little fell of any value till Christmas, when we had a good soaking rain and pretty general. Winds have been at times high, but generally fresh to strong; temperature fairly even and very warm.—(C. C. Campbell.)

ERMELO DISTRICT.—

Ermelo.—The weather during December has been more seasonable than any December since the war, and vegetation is looking its best; hot days and cool nights have predominated.—(Mrs. S. M. Nicolson.)

HEIDELBERG DISTRICT.—

Heidelberg.—Country getting dry in earlier part of month. The heavy rain on the 11th did not much relieve matters, as nearly all the rain (about 1½ inches) fell in three-quarters of an hour, and ran off very quickly. In the latter part of the month, the steady daily rains have been of great value. The soil is now looking damp and the crops, especially on dry lands, promise very well.—(L. N. Foggin.)

LICHTENBURG DISTRICT.—

Lichtenburg.—The rainfall, although not very considerable, has fallen at fairly regular intervals, and the district in the vicinity of Lichtenburg reflects the great benefit it has derived. Generally speaking, the country looks very promising for the forthcoming season. A feature of the month has been the exceptionally strong winds experienced up to about the 25th, and chiefly from the N.E. and N.W. About 3 a.m. on the 30th a very heavy peal of thunder was experienced, followed by a very heavy thud, somewhat similar to a very heavy substance falling; the force of the shock shook every building in the town; this peal was followed by 0·70 inches of rain within 30 minutes.—(H. Atkinson.)

MIDDELBURG DISTRICT.—

Middelburg.—Rains during the month have often run banks full; country appears luxurious with verdure; springs long dry have once more started; roads in many places washed away from exceptionally heavy falls of rain for first time these four years: much damage done in parts by hail-storms during month, especially by that on the 15th.—(Dr. H. A. Spencer.)

POTCHEFSTROOM DISTRICT.—

Klerksdorp.—The rains this month were rather late and the country became very dry at a time when rain was badly needed. The temperature during the last week of the month was comparatively low and the moisture quite plentiful. The rainfall was above the average and has been almost the same in each of the last three months of the year.—(H. M. Guest.)

Ventersdorp.—The weather during the month has been rather cool for December, and of an unsettled nature.—(W. H. Warden, S.A.C.)

PRETORIA DISTRICT.—

Pretoria.—There was a severe hailstorm at 6.30 p.m. on the 1st. The month has been fairly hot, but a fair amount of rain has been recorded. Altogether the month has been a good one for crops.—(Pte. F. P. Hughes, A.M.S. Laboratory.)

Sunnyside.—There was about an average fall of rain this month, most of it coming during the last week, thus spoiling the holidays. Rain fell on 14 days, the heaviest fall being 1·00 inches on the 28th in one heavy shower which lasted less than 20 minutes.—(Hon. J. R. Stopford.)

WAKKERSTROOM DISTRICT.—

Volksrust.—Several heavy thunderstorms, with hail, but no damage was done in town; wind has been above the average: bright and warm weather wanted to ripen agricultural products.—(Lieut. J. T. R. Atwater, S.A.C.)

WATERBERG DISTRICT.—

Potgietersrust.—A very wet, dull month. Exceptionally heavy showers have fallen sometimes accompanied by strong winds, usually coming in opposite direction from the storm. All the rivers and spruits are very full. A very strange fact about the storms is that, although appearing to come from the north, very little rain has fallen outside a radius of about 20 miles north. Mapelaland, for instance, has not had one-half the rainfall registered in Potgietersrust.—(C. Kendall, S.A.C.)

ZOUTPANSBERG DISTRICT.—

Leydsdorp.—Frequent thunderstorms, one very severe on night of 13th, doing small amount of damage. Weather exceptionally cool for time of year.—(A. Chandler.)

Mamathola.—The month has been wet with several thunderstorms overhead and in vicinity; only nine fine days; rivers flooded on two occasions.—(H. W. Molyneux.)

Diana, Spelonken.—The month has been singular for the frequency of thunder storms from the west; good growing weather predominated, but the curtailment of sunshine has been most marked.—(J. Douglas Howard.)

R. T. A. INNES, *Director.*
Transvaal Meteorological Department.

Government Observatory,
Johannesburg, 8th January, 1907.

JANUARY, 1907.

District.	Place.	Month. Jan., 1907. Ins.	Days.	Season. From 1st July, 1906. Ins.	Days.
Barberton	Barberton	4·74	14	21·94	59
	Komati Poort	5·16	10	29·89	51
Bethal	Bethal	9·39	16	24·04	60
Bloemhof	Bloemhof	5·32	14	12·92	47
Carolina	Machadodorp	8·08	19	24·34	70
Ermelo	Ermelo	6·96	16	23·92	65
Heidelberg	Heidelberg	6·45	14	18·12	48
	Vereeniging	5·24	15	14·49	54
Lichtenburg	Lichtenburg	5·52	17	12·82	48
Lydenburg	Pilgrims Rest	7·60	20	21·33	80
Marico	Zeerust	5·31	13	19·67	46
Middelburg	Middelburg	9·85	21	26·65	73
Potchefstroom	Potchefstroom	5·66	13	14·52	38
	Klerksdorp	7·20	17	17 28	51
Pretoria	Arcadia, Pretoria	9 79	18	23 34	61
Standerton	Standerton	6·13	13	19·81	50
Swaziland	Mbabane	7 91	16	30 49	76
Wakkerstroom	Volksrust	12 48	19	30·79	68
Waterberg	Nylstroom	8·18	16	23·60	45
Witwatersrand	Joubert Park, Johannesburg	7·56	17	24·00	57
	Government Observatory	7·23	20	22·64	61
	Zuurbekom	5 01	9	15·64	10
Zoutpansberg	Leydsdorp	3·49	13	—	—
	Hospital, Pietersburg ..	5·47	14	20·22	54
	Louis Trichardt	9·02	16	30 68	76

SUMMARY.—The rainfall for January has been much heavier than in the corresponding month last year, it has also been generally much above the average, but does not make a "record" where more than a few years' observations are available. The season's rainfall so far is also much above the average.

The prevalence of cloud and the absence of drying winds, reducing evaporation, have resulted in the country becoming very wet.

* * * *

OBSERVERS' WEATHER REPORTS FOR JANUARY, 1907.

BARBERTON DISTRICT.—

Barberton.—The month has been marked by no excessive heat and the variations of temperature have not been great. There has, however, been an unusual amount of cloud, and the mist over the valley has been a marked feature of the evening landscape. The month has been practically windless, with the exception of a storm, accompanied by much rain in the early hours of the 11th.—(J. B. Drake.)

BLOEMHOF DISTRICT.—

Bloemhof.—A splendid month, ample rains for all needs, but not excessive; moderate temperatures and beautiful days. The frequency of thunderstorms is remarkable, several following one another during a day; winds gentle to fresh and pleasant.—(C. C. Campbell.)

ERMELO DISTRICT.—

Ermelo.—The weather during January has been seasonable. A good deal of rain fell during the month, but as it fell on 16 days, the moisture has been maintained and

vegetation has not suffered as in previous Januaries from long spells of drought and heat. Rivers in flood—(Mrs. S. M. Nicholson.)

MIDDELBURG DISTRICT.—

Middelburg.—The amount of rain during the month is considered to have been phenomenal in this district, the rivers never having been known to be so full. Streams and rivers have washed away their banks in some places; in others thrown up such quantities of sand and stubble as to quite deflect their courses; drifts have remained impassable after the subsidence of the waters by reason of their approach being excavated by rushing torrents and strewn with large rocks and heaps of sand and stubble. The roads throughout the district have in many cases been converted into water channels and rendered quite impassable; in other cases they have been buried under feet of sand or earth from neighbouring ploughed lands and quite obliterated. From 8th to 23rd it was not possible to move about the district at all, the smallest spruit being impassable.

The rain has often been exceptionally heavy and for long periods at a time. It has mostly, or at intervals, been accompanied by thunder and lightning, the former being sometimes practically continuous for hours at a time—one continuous rumble. Hail has been seen during the course of several of the storms to fall. All low lying crops have been under water most of the month and generally considered to have been ruined: potato crops have also, in many places, been ruined. On the higher grounds, where the crops have usually been poor, the crops this year are expected to be almost phenomenal.

It has been demonstrated to me for the first time in my experience of 14 years in South Africa how a town such as this may be absolutely cut off from all communication with the district for as long as ten days at a time but for the presence of a bridge, and a very substantial one.—(Dr. H. A. Spencer.)

POTCHEFSTROOM DISTRICT.—

Ventersdorp.—Good steady rains throughout the month; cool on the whole for January. —(W. H. Warden, S.A.C.)

PRETORIA DISTRICT.—

Roberts Heights.—A record month for rain. During the last four years the nearest approach to it was November, 1904, when 7·33 inches fell. Hailstones fell on the 25th, but they were only small soft stones and did no harm. A satisfactory month from an agricultural point of view.—(Pte. F. P. Hughes, R.A.M.C.)

Sunnyside.—A very wet month, the rain being very evenly distributed throughout the entire 31 days; the heaviest fall occurred on the 17th, when the gauge recorded 1·95 inches, although it was heavier a short distance away. Some of the storms were very local and often confined to quite a small area.—(Hon. J. R. Stopford.)

RUSTENBURG DISTRICT.—

Wolhuterskop.—A very satisfactory month in every way.—(J. C. P. Maynard.)

WATERBERG DISTRICT.—

Nylstroom.—Excellent rains have fallen during the month. Thunderstorms have been frequent, with sometimes very heavy rains, almost all over the district; although there are prospects for good crops, the heavy rains have in places done considerable damage. The spruits and rivers are full and many drifts are entirely unfordable.—(W. Collins, S.A.C.)

ZOUTPANSBERG DISTRICT.—

Leydsdorp.—Fairly cool month and very little sunshine; a good amount of rain fell during the middle of the month, causing rivers to swell; crops in places spoilt through too much rain. Swarms of voetgangers throughout the district.—(A. Chandler.)

R. T. A. INNES, *Director,*
Transvaal Meteorological Department.

Government Observatory,
Johannesburg, 5th February, 1907.

RAINFALL: PRETORIA (GOVERNMENT BUILDINGS).

MONTHLY AND SEASONAL TOTALS, 1891—1907.

Height of Rain-gauge above ground, 70 feet.

SEASON.	JULY.		AUGUST.		SEPTEMB'R		OCTOBER.		NOVEMBER.		DECEMBER.		JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.		TOTAL.	
																									Ins.	*Days.
1891—92	—		—		—		—		5·56	15	1·77	7	3.58	10	4·60	11	2·69	11	0·88	8	1·09	5	0·00	0	22·30	81
1892—93	0·00	0	0·00	0	1·34	2	3·38	14	1·20	8	3·81	13	11·81	19	8·81	10	2 06	11	0·87	2	0·00	0	0·20	1	33·48	80
1893—94	0·47	3	0·11	2	3·70	6	1·72	10	6·69	16	3·07	15	11·03	16	4·49	13	2·66	12	1·09	7	1·93	4	0·08	1	37·04	105
1894—95	0·00	0	0·41	4	1·20	5	2·90	7	2 98	13	8·36	19	4·46	18	3·02	12	3·78	8	0·32	6	0·25	3	0·00	0	27·68	95
1895—96	0·00	0	0·00	0	0·10	1	0·33	4	2·36	15	6·11	16	1·37	5	7·73	13	2·29	10	1·51	8	1·16	6	0·95	3	23·91	81
1896—97	0·00	0	0·35	4	0·79	4	1·06	7	1·80	9	3·62	17	5·78	14	3·10	11	3·50	8	0·33	5	0·53	2	0·00	0	20·86	81
1897—98	0·00	0	0·26	1	0·13	3	2·53	14	2·70	8	7·48	16	11·20	16	1·09	8	1·87	12	0·35	5	0·21	4	0·00	0	27·82	87
1998—99	0·00	0	0·23	1	0·53	2	0·76	3	4·75	11	2·28	13	5·45	19	1·56	5	2·38	14	0·75	5	0·48	3	0·06	2	19·23	78
1899—00	0·08	3	0·01	1	1·77	3	2·06	7	2·64	11	5·65	13	7·03	13	2·97	9	3·58	11	1·18	6	0·00	0	0·55	3	25·52	80
1900—01	0·15	3	0·10	2	0·00	0	0·87	7	7·49	13	3·10	13	4·83	12	1·37	6	6·32	20	1·74	6	0·01	1	0·07	3	26·05	86
1901—02	0·01	1	0·45	2	1·34	5	4·54	1	6·27	11	2 66	13	4·22	14	4·18	14	3 25	9	1·70	5	0·27	2	0·01	1	28·90	88
1902—03	0·03	1	0·02	1	0 33	2	2·65	7	2·80	12	5 78	18	3·13	15	2·44	9	2·45	10	4 82	11	0·33	5	0·00	0	24·98	91
1903—04	0·00	0	0·00	0	0·21	2	1·25	5	5·53	13	4·07	12	3·96	10	5·45	13	7·40	14	0·38	5	0·10	1	0·07	1	28·42	76
1904—05	0·00	0	0·02	1	0·34	1	0·23	4	5·86	12	2 70	13	1·92	14	3·29	11	4·94	9	1·51	6	0·74	3	0·00	0	21·55	74
1905—06	0·00	0	0·16	1	0·34	2	1·15	4	2·73	11	3·47	8	3 37	15	5·31	13	2·65	12	0·43	2	0·08	2	0·00	0	19·69	70
1906—07	0·00	0	0·00	0	0·36	2	3·35	9	4·50	13	3·64	12	7·11	17	—		—		—		—		—		—	
Average	0·05	0·7	0·14	1·3	0·83	2·7	1·92	7·5	4·12	11·9	4·10	13·6	5·66	14·2	3·96	10·5	3·45	11·4	1·19	5·8	0·48	2·7	0·13	1·0	26·03	84
Heaviest fall in one day since 1st Jan., 1894	0·06		0·44		0·96		1·85		2·02		2·70		4·09		3·19		2·53		1·32		0·75		0·51			

*Assumed total for season, the amount of rainfall for the months July—October, 1891, being estimated from Johannesburg records for that period.

N.B.—For daily rainfall see previous report, pp. 149-154 (1904-5). It is well known that the rainfall measured by a gauge decreases as the height of the gauge above ground level increases. As compared with the rainfall measured at Arcadia, Pretoria, with a gauge four feet above the ground, during 1902-7 (four-and-a-half seasons) it appears that the rainfall as recorded at Government Buildings is thus deficient by one-eighth part. If the above totals are increased by this amount, the comparison is as follows :—

	Govt. Bldgs. (plus one-eighth).	Arcadia.
1902—03 ...	28·10 ins. ...	28·88 ins.
1903—04 ...	31·97 ...	31·72
1904—05 ...	24·24 ...	24·71
1905—06 ...	22·17 ...	20·61
1906—07 (7 mons.) ...	22·79 ...	23·34
Total ...	129·27	129·26

PRETORIA AND JOHANNESBURG PRODUCE MARKET PRICES.

(Supplied by the Commercial Agency Co., Limited, Seed and Produce Merchants No. 116, Vermeulen Street, Telephone No. 165, Box 784, Pretoria; and by Messrs. Hubert Morisse & Co., Produce Merchants and Commission Agents, Loveday and Frederick Streets, Box 63, Johannesburg.)

PRETORIA.

Description.	*December*, 1906.						*January*, 1907.						*February*, 1907.					
	Lowest.			Highest.			Lowest.			Highest			Lowest.			Highest.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Forage, per 100 bundles ...	0	5	6	1	3	0	0	5	6	1	7	0	0	5	9	1	3	0
Mealies, per bag	0	12	6	0	16	6	0	12	6	0	16	0	0	12	6	0	13	9
Kaffir Corn, per bag	0	10	0	0	14	9	0	11	0	0	14	0	0	9	3	0	13	9
Bran, per bag	0	8	0	0	10	9	0	7	3	0	9	6	0	8	0	0	9	0
Wheat, per bag	0	17	6	1	4	6	1	0	6	1	2	0	1	1	0	1	4	6
Oats, per bag ...	0	13	0	0	14	9		—		0	12	6		—		0	14	3
Chaff, per bale	0	3	0	0	7	3	0	4	0	0	8	0	0	3	3	0	6	3
Grass, per load ...	0	3	0	0	8	0		—		0	8	6	0	4	0	0	5	6
Hay, per bale	0	0	3	0	2	0	0	0	4	0	1	6	0	0	5	0	1	0
Bedding, per bale	0	0	6	0	0	9	0	0	4	0	1	0	0	0	4	0	0	9
Green Barley, per doz bdls	0	0	7	0	1	6		—			—			-			—	
Green Lucerne, per doz bdls	0	0	6	0	1	6	0	0	6	0	1	6	0	0	9	0	1	0
Dried Lucerne, per bale ...	0	1	5	0	2	0	0	5	3	0	5	9		—			—	
Potatoes, per bag ...	0	4	9	0	14	6	0	4	6	0	13	0	0	4	0	0	10	3
Onions, per bag ...	0	4	3	0	10	6	0	6	0	0	10	6	0	5	6	0	10	0
Eggs, per doz.	0	0	11	0	2	4	0	1	9	0	2	10	0	1	7	0	3	0
Fowls, each ...	0	1	2	0	3	3	0	1	2	0	3	4	0	1	3	0	3	0
Ducks, each	0	2	0	0	3	10	0	2	6	0	4	3	0	2	3	0	3	0
Turkeys, each	0	5	6	1	2	6		—			—			—			—	
Guinea Fowls, each ...	0	3	0	0	3	3		—			—			—			—	
Geese, each	0	5	0	0	10	3		—			—			—			—	
Oranges, per 100 ...	0	5	0	1	3	6	0	2	0	0	7	6		—		0	2	0
Naartjes, per 100 ...	0	5	0	0	7	6		—			—			-			—	
Lemons, per 100	0	5	6	0	7	9	0	5	0	0	7	3	0	4	0	0	4	6
Butter, per lb.	0	1	1	0	1	9	0	0	9	0	1	6	0	1	1	0	1	6
Pumpkins, each		—		0	0	2	0	0	2½	0	0	4	0	0	3½	0	0	6
Pigs, each	0	6	6	3	9	0	0	1	6	2	10	0		—			—	
Pigs, per lb.		—		0	0	4		—			—			—		0	0	3¾
Tobacco, per roll	0	0	6½	0	1	6	0	0	9	0	1	1	0	0	7½	0	1	6
„ cut, per lb. ...	0	0	5½	0	0	6½	0	0	5	0	0	6	0	0	3	0	0	5
„ leaf, per lb. ...	0	0	6	0	0	7		—			—			—			—	
Wood, per load ...	0	12	6	4	7	6	0	8	0	3	0	0	0	13	0	2	10	0

JOHANNESBURG.

Description.	*December*, 1906.						*January*, 1907.						*February*, 1907.					
	Lowest.			Highest.			Lowest.			Highest			Lowest.			Highest.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Barley, per 163 lbs ...	0	10	9	0	12	9	0	9	0	0	14	0	0	11	0	0	13	6
Bran, per 100 lbs. (Colonial)	0	7	6	0	8	6	0	7	6	0	8	0	0	7	6	0	7	9
Chaff, best, per 100 lbs. ...	0	3	0	0	5	0	0	3	9	0	5	0	0	3	9	0	4	6
,, medium ,, ...	0	2	0	0	3	9	0	3	0	0	3	6	0	2	6	0	3	6
Eggs, per doz (Colonial) ...	0	1	1	0	1	3	0	1	7	0	1	10	0	1	9	0	1	11
Salt, per bag	0	5	0	0	5	9	0	5	0	0	5	6	0	5	0	0	5	6
Forage, new (Transvaal) ...	0	5	0	0	5	9	0	5	9	0	7	3	0	6	6	0	7	3
,, (Col'nal) best per 100lbs	0	6	6	0	7	0	0	6	9	0	7	9	0	6	9	0	7	6
,, , med ,,	0	3	9	0	4	9	0	4	3	0	4	9	0	4	3	0	6	6
S. Meal, good	1	3	6	1	5	0	1	3	6	1	5	0	1	2	0	1	5	0
Rye	1	2	0	1	2	6	1	2	0	1	2	6	0	18	0	1	2	6
Wheat	0	19	6	1	2	0	0	19	0	1	2	0	0	17	0	0	19	9
Mealies, Hickory King Whites	0	12	9	0	14	0	0	13	6	0	14	3	0	12	3	0	14	3
,, (O.R.C.) Whites ...	0	12	6	0	13	9	0	12	6	0	14	0	0	10	6	0	13	3
,, Yellow	0	12	6	0	13	9	0	11	3	0	14	3	0	10	3	0	13	3
Kaffir Corn, per 203 lbs ...	0	12	3	0	14	0	0	10	9	0	14	3	0	10	6	0	12	9
Hay (Transvaal) per 75 lbs	0	1	1	0	2	3	0	0	11	0	1	5	0	0	9	0	1	7
Lucerne, per 100 lbs. ...	0	4	0	0	6	6	0	5	0	0	6	6	0	4	0	0	6	9
Oats (Colonial) per 150 lbs.	0	15	0	0	15	6	0	13	9	0	14	6	0	8	0	0	15	0
,, ,, 133 lbs	0	9	6	0	13	9	0	9	6	0	11	9	0	7	0	0	13	6
Potatoes, best, per 163 lbs., new	0	10	0	0	14	0	0	6	0	0	9	0	0	7	0	0	14	0
,, med ,, ...	0	6	0	0	10	0	0	4	0	0	6	6	0	4	0	0	10	0
,, inferior ,, ...	0	3	0		–		0	2	0				0	2	0		—	
Onions, good, per 125 lbs	0	6	6	0	13	0	0	4	0	0	10	6	0	3	0	0	11	0
Pigs, live weight, per lb. ...	0	0	3¾	0	0	4¼	0	0	3¼	0	0	4¼	0	0	3½	0	0	4¼
Turkeys, cocks	0	10	6	0	16	0	0	8	6	0	12	0	0	7	6	0	12	6
,, hens ...	0	7	0	0	9	0	0	4	6	0	7	0	0	4	6	0	6	9
Fowls	0	2	9	0	3	9	0	1	4	0	3	3	0	1	4	0	3	0
Ducks	0	3	6	0	4	1	0	2	0	0	3	6	0	2	0	0	2	9
Geese	0	7	0	0	9	0	0	5	0	0	7	0	0	5	9	0	7	0
Pigeons	0	1	0	0	1	1	0	0	10	0	1	1	0	0	10	0	1	
Bedding, per bale	0	0	6	0	1	6	0	0	10	0	1	0	0	0	6	0	1	0
Sweet Grass, per bale ...	0	2	0	0	2	9	0	1	3	0	2	6	0	1	0	0	1	4
Butter (O.R.C.)	0	1	0	0	1	4	0	0	6	0	1	1	0	0	6	0	0	9
Pumpkins, per 100 lbs. ...	0	3	6	0	5	0		–			– –			—.			—	
Beans, sound, per 200 lbs...	0	19	6	2	5	0	0	19	6	2	5	0	0	19	6	2	5	0

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AGRICULTURAL PROGRESS IN THE TRANSVAAL.*

THE Annual Report of the Transvaal Agricultural Department has just been issued, and as many of our farmers may not have had the opportunity of perusing this valuable volume, we take pleasure in publishing a short summary of a few of the more salient points:—

During the year the Department has progressed steadily along the lines laid down in the scheme prepared previous to its establishment in 1902. Though the policy of the Department has remained unchanged there have been extensions in various directions, and efforts have been made to perfect its organisation and equipment and to arrange for work not previously provided for. Existing divisions and offices have been strengthened where necessary, and slight re-arrangements have been made in the staff and in the duties of certain of the divisions, so as to prevent duplication and overlapping. Although much has been done towards placing the Department upon a sound basis, and it is even now a fairly efficient machine, certain additions and alterations are yet required before it can be considered to be in any way complete or capable of undertaking the whole of the duties required of it with efficiency, economy, and reasonable despatch. These matters are receiving attention, however, and it is hoped that before long they will be satisfactorily adjusted.

The Experimental Farms and Stations and the Stud Farms have proved of immense benefit to the Department in many ways; they have converted the officers of the Department into farmers, and have brought the Department directly and intimately into touch with the agriculture of the country. They have enabled the Department to obtain, in the most satisfactory manner possible, viz., by actual experience, a knowledge of the details of the systems of farming best adapted to the different parts of the Colony, to test and correct its theories and to speak with the assurance and moderation begotten of experience.

* Being a summary of the Annual Report of the Director of Agriculture, from 1st July, 1905, to 30th June, 1906.

Owing to the fact that in addition to the staff at headquarters, officers of the Department are distributed throughout the Colony, and that these men, as a rule, are constantly employed in travelling about visiting farmers or interviewing them at their offices, or replying to letters, it is impossible to furnish a complete return of the whole of the correspondence dealt with by the Department, nor of the number of visits to or by members of the staff; but the following figures may be of interest as showing in part what has been done in the direction indicated. During the year 54,103 letters and telegrams were received by the Department, and 91,126 letters and telegrams despatched. Four numbers of the English *Journal* of 8,000 copies each, and four issues of the Dutch *Journal* of 2,000 each, and 58,700 copies of the different leaflets and bulletins were published, representing a total of 98,700 publications.

The *Division of Veterinary Science* is mainly engaged in endeavouring to prevent the entrance of contagious diseases into the Colony, and the eradication of those which have already gained a footing therein.

As will be readily understood by all who possess the slightest knowledge of the country, or of the havoc wrought by contagious diseases, the fact that at the present time, despite stringent Stock Regulations strictly enforced, a good understanding exists between the Division and the farmers and that the district veterinary surgeons and the stock inspectors are welcomed by the farmers and their services appreciated and made use of to such an extent that requests are continually being made for more veterinary surgeons or more stock inspectors; and, that, whenever a veterinary officer is moved from a district either temporarily or permanently, representations are promptly received to the effect that the district is left unprovided for and cannot possibly get on without veterinary assistance, may justly be interpreted as a compliment to the veterinary officers, and as evidence that the actions of the Division are being understood and approved. This satisfactory condition of affairs may be attributed, firstly, to the fact that the veterinary officers are all highly trained and competent professional men who are now becoming well acquainted with the country and for the most part able to make themselves understood in the Taal, and, secondly, that, as far as possible, efforts have been made to take the farmers into our confidence, and to educate them by explaining the reasons for our actions and discussing our proposals with them before putting them into operation, and whenever practicable modifying them to suit their convenience.

Some idea of the enormous amount of work devolving upon the Division may be gathered from the following figures. During the year 726 outbreaks of contagious diseases were attended to. 2,074 animals died, or were destroyed as incurable, 57,935 were put under treatment, and 80,626 were examined as in-contacts. 597 farms and places were placed in quarantine, and 615 were declared free from disease. 662,919 animals were examined at the ports of entry or elsewhere upon the border, of which 651.407 were admitted, and 11,512 rejected. 2,364 mules were immunised against horse-sickness. with a mortality of 3·7 per cent.

It is satisfactory to be able to report that the condition of the Colony as regards contagious diseases of animals continues to show marked

improvement. *East Coast fever*, the disease which after the war constituted such a serious menace to the Colony, has not only been prevented from spreading but has been gradually overcome, and large areas once infected with the disease have been cleansed of it.

The number of fresh outbreaks of East Coast fever during the past year amounts to 98, and the number of cattle which died of the disease 800; as against 219 and 7,957 respectively the previous year.

The majority of fresh outbreaks occurred in the Zoutpansberg District and the northern portion of the Middelburg District, portions of the country largely inhabited by natives, and it is very probable that many of the outbreaks described as recent were not so, and that the disease had been in existence for a considerable time, though not previously discovered.

There can be no doubt that if the policy now adopted is vigorously enforced the disease will be entirely exterminated before long, though owing to the fact that its last strongholds will be parts of the Colony most thinly populated with Europeans and thickly populated with natives, it will be more difficult to deal with it there than it has been in those parts which have already been cleared.

Next to East Coast fever, the disease which has exercised the minds of the farmers most, and which has inflicted the greatest losses upon them, is *Scab*. Until recently, scab was regarded as a necessary evil; something that was natural to the country and self-produced, and against which it was useless to contend. The fact that, owing to the teachings of Dr. Theiler and the Veterinary Division, these fallacies have been exploded, and scab is now generally recognised as a disease caused by a specific organism, and that with proper sanitary precautions it is quite possible not only to keep individual flocks free from it, but to eradicate it altogether, testifies to the aptitude of the farmers to profit by instruction when properly given.

It is true that even after people have been enlightened to the extent of being brought to realise and admit the possibility and advantage of a certain course of action, it is sometimes difficult to induce them to submit to the restrictions or to take the steps necessary to attain the object arrived at, but in this particular instance it is not apprehended there will be much trouble, for the farmers realise the enormous losses caused by scab, both in the condition of their sheep and in the wool, and that to get rid of it will be well worth the expense and inconvenience involved.

At the urgent request of the sheep farmers in the principal sheep-raising districts, the scab regulations have been amended so as to render them more stringent, and to provide for the compulsory dipping of all flocks at a certain season of the year. The number of private dipping tanks in the country is rapidly increasing, which is a very hopeful sign, for if every farmer will dip his sheep twice a year as he ought to do in his own interest, whether scab be present or not, the disease would soon be greatly diminished.

The annual trekking of sheep from the high to the low veld, and *vice versa*, is a very troublesome factor to contend with, as the main stock

routes soon become contaminated by such movements, and it is almost impossible to trek sheep without their contracting the disease, and thus spreading it afresh in the country. Fortunately, though for other reasons which need not be discussed here, trekking appears likely to be less prevalent in the near future, so the evil will be diminished in intensity, but it is certain that if the disease is to be extirpated, and the farmers through whose farms these sheep trek are to be protected from infection as is only right they should be, measures will have to be taken to see that all sheep are dipped and clean before they are allowed to travel.

An energetic crusade has been conducted against *glanders*, particularly in Johannesburg, as it is the towns which harbour this disease most, and from which outbreaks in the country can usually be traced. By attacking the disease at the fountain head it is hoped that before long it will be greatly reduced, if not extirpated altogether. The number of outbreaks dealt with last year showed a slight increase over the previous year, viz., 135 as against 107, but this is probably due to the stricter supervision which has been exercised in Johannesburg rather than to the spread of the disease.

Tuberculosis is reported not to have made serious headway, but as stated by the Principal Veterinary Surgeon, it has undoubtedly obtained a foothold in South Africa, and he draws attention to the prevalence of the disease amongst cattle imported from Madagascar. Tuberculosis amongst cattle is a very serious matter, inasmuch as it is believed the disease is communicable from them to human beings, and its eradication is a very difficult and expensive business, and intending importers of cattle or purchasers of cattle which have been imported or of dairy cattle from Cape Colony would be well advised to adopt the Principal Veterinary Surgeon's recommendation and insist upon their animals being tested by a reliable veterinary surgeon before accepting them.

The reduction in the number of outbreaks of *lungsickness* is as remarkable as it is gratifying; only eight outbreaks were reported during the year, and it is probable that the Transvaal has never been so free from this disease since it was first introduced, as it is to-day.

There has also been a noticeable reduction in the number of cases of *epizootic lymphangitis*, viz., 67, as compared with 114 in 1904-5.

Swine fever has shown a slight increase, though, as the Principal Veterinary Surgeon remarks, it is probably more prevalent than the returns would lead one to believe, inasmuch as the majority of owners of pigs keep but very few animals to which they do not attach any great value or importance, and if they happen to die, simply submit to the loss without notifying the Department, with the result that the cause of death is not investigated. Such conduct is very reprehensible, for it may result in the spread of the disease, and occasion great loss to many people.

Anthrax.—The number of reported outbreaks of anthrax was small, only 10, but it is doubtful whether these figures represent the extent of the disease. Owing probably to the carelessness of farmers disposing of the carcases of animals which died from the disease, some farms in the South-West Districts are said to be contaminated to such an extent that they are almost useless for stock raising.

Mange, which was frightfully prevalent after the war, appears to be fast disappearing.

There have been no outbreaks of other scheduled diseases such as *rinderpest*, and *foot and mouth disease*.

Rabies.—Fortunately this dread disease has not yet made its appearance in the Transvaal, but as the Principal Veterinary Surgeon remarks, its presence in Rhodesia in close proximity to the Transvaal border naturally gives rise to anxiety. In the hope of preventing its admission, a strip of country 50 miles wide along our Northern border has been cleared of dogs. Such precaution will not preclude the possibility of the introduction of the disease by wild carnivora, but will greatly diminish the risk.

In order to be prepared for the disease should it make its appearance, arrangements will be made for the additional Assistant, about to be appointed to the Bacteriological Laboratory, to go through a course of anti-rabic treatment at the Pasteur Institute, Berlin, in order that he may be able to practise the same here if necessary.

Speaking of the *Veterinary Bacteriological Laboratory and Experiment Station*, Mr. Smith says:

The staff has been strengthened by the appointment as Assistant Veterinary Bacteriologist of Mr. S. Dodd, M.R.C.V.S., late Demonstrator of Pathology and Bacteriology at the Royal Veterinary College, London, and Assistant to Professor Sir John Macfadyean; and of Mr. E. B. H. Parkes as Superintendent. These appointments were rendered necessary by the rapid growth of the Station.

Mr. Dodd, who, in addition to being a thoroughly competent Bateriologist, is familiar with the preparation of mallein, tuberculine, quarter-evil vaccine, etc., will have charge of the manufacture of those diagnostics and vaccines; whilst Mr. Parkes will look after the business side of the Station, and so relieve Dr. Theiler of the duties connected therewith.

Whilst in Europe, on leave of absence, Dr. Theiler visited the leading Veterinary Colleges and Bacteriological Laboratories in England and on the Continent and in order to renew his acquaintance with the scientists working therein and to obtain information as to the latest improvements in methods and equipment; he also represented the Transvaal at the International Veterinary Congress held at Buda-Pesth last September. The proceedings of the section of the Congress dealing with diseases of warm countries was particularly interesting as it was attended by the leading authorities upon those diseases. The conclusions and recommendation of the Congress which more directly concern the Transvaal are clearly set forth in Dr. Theiler's report.

As will be gathered from Dr. Theiler's report, the Sub-division has accomplished an immense amount of work during the year

What may be termed the routine work of the station was very heavy, and involved the receipt of 2,517 letters and telegrams and the despatch of 2,837, and the granting of a large number of interviews to farmers and others interested in the work of the station or desirous of information regarding animal diseases.

1,111 pathological specimens and blood-smears were examined for diseases of various kinds, which, as will be observed from the list attached to Dr. Theiler's report, included a great many different diseases, though, as was to be expected, the majority related to East Coast fever. The reliability of the examination for that disease is evinced by Dr. Theiler's statement that he has not met with a single instance of East Coast fever occurring in any animal in whose blood the particular organism which produces the disease was not discernible when examined under the microscope.

The inoculation of mules against horse-sickness upon a large scale was put into operation for the first time last year. The inoculation was carried out at various centres by the District Veterinary Surgeons—who has attended a course of instruction at the Laboratory—and was most successful. 2,325 mules were inoculated in the Transvaal and Swaziland and 388 in Rhodesia; the loss due to the operation was 3.8 per cent. in the one case and 2·3 per cent. in the other.

The losses from horse-sickness amongst these mules plus 522 previously treated, or 3,235 in all, amounted to ·6 per cent., but it should be pointed out that this figure includes several deaths the cause of which could not be determined with certainty, and which may or may not have been due to horse-sickness. 1·3 per cent. of the animals showed signs of the disease re-appearing, but recovered upon being rested.

Thus, for the first time in the history of the country, it was possible to trek with mules in any part thereof throughout the whole summer.

In the course of his investigations, Dr. Theiler has confirmed the common belief that horses may be salted for one district and not for another be demonstrating that horse-sickness varies in virulency in different districts, and, in order to provide against this, the mules which have been treated have been subject to the most virulent strain yet discovered.

With regard to the *Division of Botany* the Director states that an immense amount of work has been accomplished during the year, and the demands made upon the Botanist's time in the shape of correspondence, interviews, and attendance at meetings of farmers, and of visits to farms, have become so great as to severely tax his energies, and to prevent his devoting as much attention as could be wished to the more strictly scientific side of his work. This is gratifying, as illustrating the use which is being made of the Division, but in another sense regrettable inasmuch as real progress is usually based upon the results of scientific investigations: and it is this work which is in danger of being crowded out, unless measures are taken to prevent it.

Steady progress has been made with the herbarium of economic plants, which now number some 6,000 specimens.

The procuring of new varieties of seeds and plants from abroad, and the testing of them, together with the more promising of the crops previously introduced, has been continued; and so also has the system of conducting the tests in the first instance at the Experiment Station at Skinner's Court, or upon one or other of the Experimental Farms, and afterwards upon a more extensive scale in conjunction with progressive farmers resident in different parts of the country.

Thirteen tons of farm seeds were issued from the Seed Store last year in 7,168 packets. A portion of these went to the Experimental Farms, and the balance to 517 farmers for co-operative experiments.

Some of the crops introduced by the Department appear likely to prove of service to the country, and teff-grass in particular is very promising. Cotton has given good results in the Eastern Middle Veld, and the samples sent to England have been favourably reported upon. The cultivation of lucerne has aroused a good deal of interest, and so has the growth of other root and forage crops, such as mangels, velvet beans, cow peas, millets of various varieties, and grasses of different kinds, and also oil and fibre plants like castor-beans, pea-nuts, sisal, ramie, etc., full particulars of which will be found in the Botanist's report.

The selection and crossing of mealies, with a view to securing heavy-yielding and early maturing varieties, is being proceeded with.

Poisonous plants occasion heavy losses to stock-farmers in certain parts of the country, and the habits and properties of these plants are being studied with a view to discovering a means of eradicating them, or of treating animals which have partaken of them.

Weeds injurious to stock, wool, and crops have also received attention, with the idea of preventing the introduction of fresh ones, and the extirpation of those already present.

Attention has been devoted to rusts in cereals, grasses, and other plants ; this disease being of the utmost importance to the Colony inasmuch as it prevents the growth of wheat or barley, and to a great extent oats, during the summer months.

Some 250 sorts of wheat, barley and oats were tested at Skinner's Court, and 1,063 cultures of rusts affecting these cereals were carried out in the green-house attached to the laboratory.

Many other diseases have been under observation, and as far as possible will be worked at in the order of their importance to the farmers, or of the likelihood of being able to devise a method of dealing with them. It is significant of the want that existed for a trained scientist to investigate diseases of plants, that in addition to the large number of requests for information and assistance from our own farmers, numerous applications of a similar character have been received from farmers and fruit growers in other South African Colonies, and at the request of the Government of Cape Colony, Mr. Pole Evans is conducting investigations into "bitter pit," a disease which seriously menaces apple-growing for commercial purposes in that Colony.

Referring to the *Division of Forestry*, Mr. Smith remarks :

Good work was performed by this Division during the year. The nurseries and plantations which were first established are making good progress, and so is the work of demarcating, conserving and renovating the natural forests and bushes in the districts of Lydenburg and Zoutpansberg. The interest in forestry is increasing, and trees have been distributed and planted in every part of the Transvaal.

It is true the work accomplished, when compared with what could or ought to be done, is not very great ; but in this, as with many other things, it is better to go cautiously at first, and to undertake only as much work

as can be done justice to, and then, as that becomes more or less established, to take up more work and so on. In fact, it is much better to allow the division to develop in a natural and economical manner—which, after all, like a tree properly planted in good soil will be rapid enough when once it is firmly rooted—rather than to attempt too much at first and to commit the mistakes and extravagances which usually result from such action.

The Public Service Commission recognised the high importance of the work performed by this Division, and recommended that the money granted to it should, if possible, be increased. At the present time nurseries and plantations have been formed, and are well under weigh at eight centres, and a nursery alone at one; and it is hoped that these will be increased from time to time.

The Conservator refers to the consumption of timber by the mines in and around Pilgrims Rest, and points out that if it continues at the present rate there will be a serious shortage of timber there before long. He also comments on the suitability of that portion of the Lydenburg District, between Pilgrims Rest and Nelspruit, for the growth of timber, and of wattles for bark, provided railway facilities were forthcoming.

At each forest station an arboretum has been laid out, in order that definite information as to the behaviour of any trees at all likely to prove adaptable to the Transvaal can be obtained. Tests are being conducted with native trees as well as imported. This is a feature of the work of the division which will prove of enormous value to the country in time to come, for, as in many other branches of the work in which the Department is engaged, there is a serious lack of data relating to this subject; the selection of the right variety of tree for planting in any particular district is a matter of supreme importance, as a mistake of this nature may not be detected for many years and after the loss of much valuable time and the expenditure of large sums of money.

The Conservator of Forests went to Europe on leave during the year; a considerable portion of his vacation being spent in the forests in the South of France, enquiring into the methods of forestry in vogue there. Shortly after Mr. Legat's return Mr. Grenfell, Assistant Conservator, resigned, in order to practise as a consulting forester in London.

The *Division of Entomology* has rendered valuable service.

On the whole, the past year has been the most successful in the history of the Division, as the staff are now better acquainted with the needs of the farming community, and consequently in a position to be of more use to it. Many demonstrations were held in the different parts of the country, illustrating the method of cyanide fumigation of trees, cyanide fumigation of buildings for vermin, and the fumigation of ants.

A conference was held at Bloemfontein of the Entomologists of the various South African Colonies, at which a Plant Import and Nursery Regulation Ordinance was drafted, suitable for the adoption of the different South African Colonies in order to obtain uniformity of action

As described in the report of the Entomologist for last year, a great number of brown locusts flew into the Transvaal during June and July.

The infestation was particularly heavy in the Rustenburg district, and in some instances the whole ground was covered with locusts, it being reported that one area 18 miles long and 16 miles wide was practically a sheet of locusts. As a result of the efforts of the Division no crops were injured by voetgangers, and almost every swarm was destroyed, the total number being 900.

In the course of the campaign some 2,000 swarms were killed. The general result of the operations was that no damage was done to crops, and the farmers were convinced that locust destruction was a practical thing. Actual field tests have demonstrated that the spraying with arsenical solutions is the most effective and economical method which can be used in the destruction of voetgangers. At the end of the fiscal year there were 600 spray pumps, and 16 tons of arsenite of soda in stock for the coming locust campaign. The necessity of an Inter-Colonial Locust Bureau for the collection and dissemination of information regarding the prevalence of locusts throughout South Africa is becoming more and more apparent, and steps are being taken to obtain the co-operation of the other Colonies in establishing such a bureau.

The *Horticulturist* reports that interest in fruit-growing was maintained during the year, but that the increase in the area under fruit was not large, the chief extension being in citrus fruits. This is regrettable, as the amount of money sent out of the country each year for fruit that could quite well be produced here is very considerable. Last year the imports of fruit of all kinds, including jams and preserves, were valued at £230,018, which for a small population like ours is a very large sum indeed.

The Horticulturist also draws attention to another unsatisfactory feature connected with fruit-growing in the Colony, and that is the lack of enterprise on the part of local nurserymen. So far nearly the whole of the fruit trees and vines planted in the Colony have been obtained from Cape Colony or Natal, or from abroad. From experience gained on the nurseries connected with the various experimental orchards, it has been conclusively proved that good trees—better indeed than many of those imported—can be raised in this country.

The Regulations framed under Ordinance No. 16 of 1904, to prevent the introduction and spread of insect pests and diseases of plants, are stated to be working well on the whole, though they require amending in certain particulars.

One of the features of the year was the success which attended the collection of citrus fruits forwarded by the Division to the Royal Horticultural Society's exhibition in London in June last. The fruit, which arrived in splendid condition, attracted great attention, and was stated to be one of the finest collections of citrus fruit ever seen in London.

No less than seven medals, including a gold one for the best collection of citrus fruits, were awarded to the Transvaal exhibit.

In this connection a short extract from a letter received from the secretary to the Royal Horticultural Society may not be out of place, particularly as the points mentioned therein may be taken to apply to all fruits intended for export.

The Secretary writes :—

"There is doubtless a great future open to your produce provided
(1) That quality is maintained in size, colour, consistency, flavour, etc.;
(2) That quantity is approximate to the demand;
(3) That retail price is not a fancy one.
We badly need citrus fruits all the summer through, and our lemon supply often falls short. It is inadvisable to send any but the best and not too great a variety at first."

The systematic analysis of soils with the idea of compiling a soil survey of the Colony is proceeding and constitutes the main work of the *Division of Chemistry*. Details of many of the analyses of the soils are given in the report of the Division in order to illustrate the chief facts revealed by the investigations. Analyses of 237 samples of soils, manures, foodstuffs and other substances were made for farmers during the year.

The report also includes interesting discussions upon (*a*) the natural manurial resources of the Colony, (*b*) and accounts are given of researches in connection with osteo-porosis, an obscure disease of the bones that occasions great losses to owners of equines, which is being conducted in conjunction with Dr. Theiler; so far it has not been possible to definitely ascertain the cause or nature of the disease, but the evidence which has been obtained appears to indicate that the use of foods such as oathay and mealies, which contain an excess of phosphoric acid as compared with lime, if not the cause of the disease, has the effect of rendering animals susceptible to it; of (*c*) bitter pit in apples, a disease which is being investigated in conjunction with the Plant Pathologist, and to which further reference is made in the notes of the report of the Division of Botany; and of (*d*) combined nitrogen in rainwater.

In all 40 different publications were issued by the *Editorial Division* during the past year. The *Journal* continues to maintain its high standard, and is widely read and greatly appreciated. In order to keep pace with the increased demand, the issue has been raised to 8,000 copies, and even this is insufficient as the last number is almost out of print.

In addition to applications for the current number of the *Journal*, requests are constantly being received for back numbers required to complete sets, thus indicating that the articles in the *Journal* are sound and of abiding interest, and that it is proving useful as a work of reference—the greatest compliment that can be paid to a publication of this character. The Dutch edition of the *Journal* is growing in favour with the farmers, and its circulation was increased from 1,000 to 2,000 copies.

The demand for the various bulletins and leaflets is increasing. These publications dealing as they do with special phases of agriculture, and expressed in simple and concise language, are of great assistance to the farmers, and are also exceedingly useful to the Department inasmuch as they furnish complete replies to the requests which are constantly received for information upon the subjects with which they deal, and thus tend to materially lighten our correspondence.

An endeavour will be made to prepare those bulletins which treat of suitable subjects so that they can be eventually collected together and provide chapters in a text-book of agriculture for this Colony.

The library has continued to develop steadily, and 5,000 books and publications have been added thereto during the year.

Respecting the *Division of Poultry*, Mr. Smith remarks that the work involved in managing the station at Potchefstroom, attending to visitors, and in dealing with correspondence, has been so heavy as to debar Mr. Bourlay from moving about the country as much as he would like, and from devoting the attention to educational and experimental work which is so desirable.

Some idea of the volume of the work may be gathered from the fact that there were no less than 1,665 visitors to Potchefstroom last year, and 1,660 letters were dealt with. The stock raised at Potchefstroom number 947 head, and at Ermelo 301; 246 sittings of eggs were sold and 370 head of stock.

Interest in poultry-keeping, particularly as regards egg production, is growing, and the efforts of the Government are being supplemented by an increasing number of private individuals, some of whom are taking up the subject more or less as a hobby, though usually with the hope of getting some pecuniary return from it, whilst others are embarking on strictly commercial lines.

The immense importance of the poultry industry to the country may be seen in the value of eggs and poultry and game imported into the Transvaal during the last financial year, which amounted to no less than £124,464 and £83,863 respectively, and there is little doubt that if poultry and eggs could be delivered to the consumer at a reasonable price, the consumption would be enormously increased.

Concerning the *Experimental Farm at Potchefstroom*, the Director writes:

This farm has made steady and substantial progress during the year, and though it has been in existence for such a short time, it has attained a degree of development which is remarkable, even for a country like this, and is exercising a wide and rapidly growing influence upon the agriculture of the Colony, as is evinced by the enquiries received for information on points connected with agriculture and stock-raising, by the visits to the farm of farmers in search of information, by the applications received from young men to be received as pupils upon it, and by the demand for live stock and seeds raised upon the farm.

The erection of a further instalment of the permanent buildings upon the farm was commenced towards the end of the year, and when they are completed will form a welcome addition to its equipment. Amongst other buildings will be a working dairy. When it is completed, and an instructor is forthcoming, it will be possible to hold courses of instruction in fruit growing, poultry keeping and dairying, as well as in ordinary farm management. What is greatly required is a hostel to accommodate from 20 to 40 students, a large lecture hall, and one or two smaller class rooms. Inasmuch as the farm is now in a position to do justice to students, and

numbers of young men are manifesting a desire to come as such, it is most desirable that arrangements should be made for their reception.

The season was anything but favourable, the rainfall being deficient and falling at unsuitable times, whilst the supply of water for irrigation purposes was erratic, and tended to become short when most required.

A good deal of damage was caused by locusts late in the year.

Despite the drought and the locusts, the crops were fairly good and much better than was expected. Full details of the crops grown, and the experiments conducted with them, are given in the Manager's report.

The live stock have, on the whole, continued to thrive, though the imported animals have required constant attention, and a good deal of trouble has been experienced from ordinary redwater and other ailments amongst the cattle, and from "blue tongue" amongst the sheep. These troubles are being overcome, however, as experience is gained, and it is satisfactory to note that the stock bred upon the farm have remained remarkably healthy.

In November, 1905, the first sale of pedigree stock bred upon the farm was held. The sale was largely attended, and good prices were realised. The value of live stock sold during the year amounted to £2,325.

A consignment of live stock consisting of 8 Lincoln red heifers, 4 Ayrshire heifers and 1 bull, 3 large white pigs, 6 large black pigs, 1 Tamworth boar, 6 Berkshire pigs, 2 Suffolk rams, 2 Shropshire rams, was imported from Great Britain, so that with births and purchases the number of stock upon the farm is now becoming fairly large.

Broadly speaking, the chief lessons to be learned from the working of the farm, independently of the multitude of experiments with varieties of crops, manures, etc., during the past season, and indeed up to date, are as follows :—Firstly, the importance of thorough cultivation ; secondly, the necessity for fertilising the soil, for, as remarked by the manager, the ground is naturally so poor that without manuring much of it would not be worth cultivating ; thirdly, the use of labour-saving machinery ; and fourthly, the need of constantly watching and attending to imported live stock, and of providing food and shelter for them during the winter months.

The expenditure upon the farm is gradually decreasing, and the revenue derived from it increasing. A considerable proportion of the expenditure was, as in former years, for permanent improvements

Touching the *Standerton Stud Farm*, it is satisfactory to be able to report that despite the adverse season, the animals upon the farm have remained healthy, and have kept in good condition during the year.

The idea is to raise the farm to as high a state of perfection—both as regards live stock and equipment—as is consistent with reasonable expenditure. To this end, the animals which are not quite up to the standard of the farm, or are for other reasons unsuitable, are being gradually weeded out and replaced by others. In the same way the erection of fencing, planting of trees, providing of better water supply, etc., are being proceeded with as opportunity offers.

During the year five stallions were sold for various causes, and four stallions, viz., "Mon Roy," by Orme—Mon Droit; "Kennithorpe," by Calthorpe—Kenny; "Brakeaway," by Prisoner—Panamag; "Anchovey,"

by St. Michael—Sauce; and 13 brood mares were purchased. Eight high-class Catalonian jack donkeys were imported from Spain for the purpose of breeding mules from half-bred mares. They are fine animals, standing about 14½ hands, with plenty of substance. 18 stallions were at stud, of which five were retained upon the farm, the remainder being leased to farmers in different parts of the country. The demand for stallions was such that several more could have been leased had they been available.

Approximately 700 mares were served, or an average of nearly 40 per horse—a considerable advance on last year.

The stallions which have been leased gave general satisfaction, and as a rule farmers who hired horses the year before applied for the same horses again last year. This is a wise proceeding on their part, as the use for the same sire for two or three years in succession will tend to uniformity of stock. There was a fair crop of foals, and the yearlings, though a little disappointing as to size, are healthy and full of quality.

The herd of Texan cows did well (48 cows producing 47 calves), and the same may be said of the sheep, goats and pigs.

It is hoped that next year a flock of high-class merino sheep will be established on the farm, and that some pure-bred cattle will also be obtained, so that before long the whole of the stock upon the farm will be pure-bred.

The *Ermelo Experimental Farm* is gradually being got into condition for working in an effective and economical manner.

The stock upon the farm has increased satisfactorily, and the first draft of young bulls bred upon the farm were sold at the Ermelo Agricultural Society's show in February. Unfortunately, the mortality amongst the cattle has been considerable, due to the ailment which has caused so much trouble amongst the imported cattle at Potchefstroom, viz., the breakdown resulting from attacks of ordinary redwater.

The *Tzaneen Government Estate*, which was previously controlled by the Land Department, was transferred to the Agricultural Department at the commencement of the financial year.

As usual, tobacco, of which 120 acres were grown, was the main crop. A good many varieties were tried, some of them with excellent results. Tobacco for cigars and cigarettes was largely experimented with. So far the growth of these types of tobacco has scarcely been attempted in the Transvaal, but when they can be produced with any degree of perfection their cultivation is extremely profitable, and from the results obtained it would appear as if certain parts of the Transvaal are well adapted for their growth; and if this be so, and the industry can be established, it should prove of enormous importance to the country.

In addition to experimental work in the field, many experiments were made in the curing and manufacture of tobacco, and much valuable information relating thereto was obtained.

Tobacco leaf was also purchased from the farmers in the neighbourhood for cash, the price paid being calculated upon the value of the completed product, less the cost of manufacture. This has proved a great boon to many farmers who otherwise would have been unable to dispose of their tobacco. It is satisfactory to note that since the estate has been established

there has been a considerable increase both as regards the quantity and the quality of the tobacco produced in the district.

Some 1,500 packets of tobacco seed were distributed amongst 250 growers for experimental purposes.

Cotton was tested on an extensive scale. During the previous year 28 varieties of cotton were grown in small plots; last year 30 acres of land were sown with the most promising of those varieties. The yields were good, and the British Cotton Growing Association, to whom samples of the cotton were submitted by the Director of the Imperial Institute, reported very favourably upon their quality and value, as will be noted from the particulars contained in Mr. Altenroxel's report.

A power cotton gin has been erected in the factory, and in order to encourage the growth of cotton in the district, arrangements have been made whereby farmers can get their cotton ginned and baled at the factory, and receive an advance of approximately two-thirds of the value of the lint, the balance being paid after the disposal of the cotton in England.

Seed of the most successful varieties is being distributed amongst the farmers, and it is probable that a considerable area of cotton will be planted in the district during the ensuing season.

Several other fibre plants have been experimented with, the most promising being sisal, hemp and ramie There is an unlimited demand for sisal fibre at about £33 per ton delivered in Europe, and there is a good demand for ramie and other fibre also.

Moreover, it is gratifying to be able to report that the *value of branding* is gradually becoming recognised by stock-owners, and that the number of brands registered is steadily increasing.

533 brands were registered last year, as against 445 the year before, and the total number of brands now amounts to 979.

In addition to preparing the annual directory and supervising the work at headquarters and granting interviews to many farmers there, the registrar travelled about the country a great deal and explained the working of the Ordinance and the advantages to be derived from branding to 41 meetings of farmers. During the year 746 letters and telegrams were received and 1,805 despatched. It may be taken as an indication of the dependence the farmers are placing on the Department, that in nearly every instance when a farmer registers a brand he requests the Department to get a branding iron made for him. The irons are made under contract at a cost of 12s. 6d. each, and last year 573 irons were made for and despatched by the Department.

The *Inspector of Fencing*, in his efforts to eradicate East Coast Fever, has erected during the past year some 1,500 miles, and material for another 1,250 miles is in process of distribution to the various districts concerned.

Altogether 2,150 miles of fencing have been erected under the Ordinance, involving the enclosure of 180 individual farms or portions of farms, and 4 large native locations.

The policy of this Branch has been to fence, as far as possible, all isolated infected farms, and secondly to fence a row of farms along the outskirts of infected areas, in order that they may act as *buffer zones*, and

so prevent the spread of the disease. In pursuance of the latter idea, a continuous line of farms, extending from a little to the east of Pretoria to the western border of the Colony near to Mafeking, has been enclosed, thus effectually separating the infected country north of the line from the clean country to the south of it. Another line of fenced farms extends from the Natal border across Piet Retief to the Swazi-Ermelo border—a distance of about one hundred miles.

This plan of linking up farms so as to form *buffer zones* will be persisted in whenever possible, as it is of the utmost importance in preventing a general spread of the disease.

Mr. van Leenhoff, the recently appointed chief of the *Division of Tobacco Industry*, arrived in the Transvaal in April.

Mr. van Leenhoff worked at the culture, curing, and fermentation of tobacco for several years in Europe, and also studied for three years at the "Ecole d'Application des Tabacs" in Paris, under Professor Schloesing. From Paris he proceeded to a tobacco estate in Porto Rico, and from thence to the United States Department of Agriculture, so that he has been thoroughly trained in all that pertains to the tobacco industry.

Since coming to this country he has been mainly engaged in travelling about the Colony and obtaining a knowledge of local conditions.

The Division has long been required, for tobacco is a crop which has already attained an important position in the country, and there is reason to believe that if the industry be properly guided and fostered, it may develop into a very big thing indeed. So far, tobacco has been cultivated and cured in a very primitive manner, and there is great scope for improvement. Now that the Division is constituted, it is confidently anticipated that it will soon make its influence felt and become useful to tobacco growers

It is proposed to establish a central office, laboratory, fermenting room and museum, in Pretoria, and experiment stations, with curing sheds, etc., in the chief tobacco growing districts.

Relative to the subject of present requirements, Mr. Smith writes as follows:

There still remain the following branches of work to be provided for before the Department will be able to do justice to the immediate and legitimate demands upon it, viz: the grading and management of merino sheep and wool-classing, dairying, and ostrich farming.

Sheep farming is already a great industry, and there is every reason to believe that the Transvaal can produce wool of the highest quality. At the present time South African wool is not in favour in the European markets, owing to the prevalence of scab, and to much of it not being properly grown or carefully sorted and packed. The experience of Australia illustrates the benefits to be derived from the application of scientific principles to the improvement of sheep and the treatment of wool, and there is little doubt that the same procedure adopted here would yield equally good results.

When the Division of Dairying was instituted three years ago, it proved to be a little premature, owing to the unexpected difficulties in connection with diseases of cattle, and it was deemed wise to let it remain

in abeyance for a time: but now that these objections have to a great extent been removed, and the country is becoming re-stocked, and the production of milk increasing, the farmers are seeking advice as to the best methods of dealing with it; and it is the duty of the State to assist them. The fact of no less than £193,910 being sent out of the country for milk and cream last year, and £238,917 for butter and margarine, is the best argument that can be employed in favour of the fostering of dairying.

Of late considerable interest has been taken in ostrich farming. Large portions of the middle veld which are not put to much use at the present time appear to be well adapted to it, and if the industry, which is an exceedingly profitable one where it can be practised, could be established in those districts, it would be of material assistance to the country.

The remarks of the Director on the great question of agricultural education are worthy of the careful perusal of all our farmers.

In my previous reports I have dwelt upon the urgent need of agricultural education. The subject is of such moment to the Colony, and indeed to the whole of South Africa, that no apology is required for referring to it again.

The fact that it is possible to impart instruction in agriculture in the same way as it is possible to impart instruction in mining or brewing, or indeed in any of the arts or professions, is now becoming generally recognised, and an immense amount of attention and large sums of money are being devoted to the subject.

In the leading countries of the world a complete system of agricultural education, extending from courses at the Universities, approaching in scope and thoroughness those provided for students of medicine, to lectures and demonstrations of a purely technical character delivered to persons actually engaged in farming; at the colleges or experimental farms, or at agricultural shows; or indeed wherever a number of farmers can be collected together.

On the Continent of Europe, agricultural education has been developed systematically and thoroughly, and the same may be said of the United States of America and Canada. It is now 51 years since the first agricultural college was founded in the United States. In 1862 the Morrill Act, which definitely endowed a College of Agriculture and the mechanic arts in each State, was passed. To-day there are 63 such institutions, the aggregate value of whose permanent funds and equipment last year amounted to the astounding total of £16,250,353, and their joint income, exclusive of the funds received from the United States for agricultural experiment stations, to £2,353,431.

The Agricultural College at Guelph, Ontario, which was founded in 1874, has exercised an immense influence upon the agriculture of Canada, not only by training young men for positions in the Department of Agriculture, and to become leaders in the agricultural world, but by educating the rank and file of the lads from the farms, many of whom had to earn their own living, and could only spare a few months during the winter or dead time of each year for their studies; and young emigrants who, new to the country, wisely decided to take advantage of the instruction afforded before embarking in farming on their own account.

The efforts of the Government in both of the countries under consideration have been liberally supplemented by private benefactors. A short time ago Sir Wm. Macdonald gave a large sum of money to Guelph for the endowment of an institute for training school teachers in "nature study," and girls in "domestic economy," and since then he has given £1,000,000 for the establishment of a new Agricultural College in connection with the McGill University.

In the United States of America munificent gifts to the colleges are constantly announced, and only a few weeks ago a private gentleman left £200,000 to the Agricultural Department of the University of California.

The fact of agricultural education having accomplished so much elsewhere that it has come to be regarded as indispensable and worthy of all the support and encouragement that can possibly be afforded it, is the most powerful argument that could be advanced in favour of its adoption here. Indeed, it would be almost safe to assert that if we, in this country, do not adopt, in so far as is applicable, the methods which have proved so successful in other countries, some of which are now competing with us in our own markets, we shall fare very badly indeed, and instead of making headway and occupying our proper position in the world, we shall falter in the march and fall farther and farther behind.

It may be argued that the system of education advocated is very well for settled and wealthy countries like those referred to, but that it is too elaborate for this country, and that the time is not ripe for it. The reply to this is that agricultural education was established in the United States and Canada when agriculture in those countries was much in the same state as it is here at the present time; that is to say, the pioneer stage had been accomplished, and farming of a more settled nature was commencing, and there is no doubt that the agricultural colleges and experiment stations were material factors in the astonishing progress which those countries have since made

The Transvaal has only recently been occupied by Europeans, and until the last few years the little band of voortrekkers who inhabited it was almost cut off from the world owing to its geographical position and lack of communication, so, as might be expected, they are not very up-to-date, or very well versed in the methods adopted by farmers elsewhere. Again, the country, though naturally well adapted for farming, abounds in difficulties due to diseases of animals and plants, abnormal conditions of soil and climate, and to labour and other factors of an economic character.

Under the old order of things the farmers could readily satisfy their simple wants and were content with so doing, but now the situation has entirely changed, and if our farmers are to overcome the difficulties which beset them, to withstand the competition which has arisen, and to prepare to hold their own in the markets of the world, as they must if the country is to progress, then there is a supreme necessity for the best possible system of education.

The desirability of providing a means whereby bright Colonial lads can obtain the training necessary to qualify them for positions in the Department has been referred to in previous reports. At present no such facilities exist in South Africa, with the result that the various Departments

of Agriculture have to be staffed with officials obtained from other parts of the world, notably the United States of America; and *vice versa*, lads from South Africa have to be sent to that country or possibly Canada or Australia to be educated, as is now being done by the Government of the Orange River Colony.

Another cogent argument in favour of establishing and, if possible, endowing agricultural education at the present time, is that we are now living on our capital in the shape of the gold and diamonds which are rapidly being extracted from the earth, and unless steps be taken to put agriculture upon a sound footing at once, it will be in a very bad way indeed when the mines become exhausted.

The Department is doing what it can to prepare the way for agricultural education by collecting information and by experimental work in the laboratory and on the farm.

The various experimental farms are now arriving at a stage as regards equipment and the experience gained by the officers thereon in farming in this country, when we shall be able to do justice to a considerable number of students requiring purely technical instruction upon them. Already a certain number of pupils have been received at Tzaneen and Potchefstroom, and it is hoped that before long it will be possible to hold short courses of instruction in special subjects such as dairying, poultry-keeping, fruit-growing, etc.. at the latter place.

The establishment of a School of Forestry at Capetown is also a welcome advance, for previously there was no provision for education in forestry in South Africa, despite the importance of the subject; and forest officers had either to be drafted from India, France, or elsewhere, and in order to prepare Colonial-born lads for the forest service it was necessary to send them abroad to be educated, formerly to Nancy, but of late to Yale.

Mr. Smith closes his comprehensive review of the progress of the Department with an instructive paragraph on the condition of the farmers :—

It is to be feared that last year was a repetition of the one preceding it, in that it proved disappointing to the majority of farmers.

The drought, locusts, and early frosts caused heavy losses to many, and affected all to a greater or lesser extent. The sheep farmers on the high veld and in the south-west had a good year and are prospering, and the same may be said of the best of the citrus fruit and tobacco growers and of the arable land farmers. On the whole, the description of the condition and prospects of the various classes of farmers embodied in my last report still holds good, that is to say, the better class of farmers—men with ability, energy and capital, whether they be old residents or new comers—are becoming established. What may be termed the second class—men who lack the means and capacity of the first mentioned, but who possess a knowledge of farming and are thrifty and industrious—are holding their own, and in many instances making headway, but the remainder—and unfortunately they form the bulk of the agricultural community—are, if anything, worse off than they were last year, and many of them are in very poor circumstances indeed.

The price of meat and produce of all kinds still remains very high, compared with the prices obtained for articles of similar quality in other

countries, and as the list of imports shows, the local supplies do not nearly equal the demand.

Transport facilities are improving, both as regards the extension of railways and the improvement of roads and drifts and the erection of bridges.

Diseases of live stock are being overcome and the greater part of the country is freer from contagious disease than for long before the war. Mules can now be immunised against horse-sickness ; so in many respects the outlook is distinctly encouraging ; yet in others it is not so, for the imports of produce that could and ought to be grown in the country are still very high, and numbers of farmers are in very straightened circumstances.

There is no doubt the cost of production is excessive, and every effort must be made to reduce it, for hardly as it presses upon farmers now, with the local demand far exceeding the supply, it will affect them still more severely should the internal consumpton diminish, or when the time arrives—as it is bound to do, unless the population of the country increases very rapidly—when the home requirements are overtaken and it becomes necessary to look abroad foi markets for our surplus products.

It would be out of place here to enter into a discussion of the various causes which render agriculture in the Transvaal so expensive, interesting as such a discussion would be. But, as mentioned in my last report, many of the difficulties against which the farmers are now contending, arise from causes which were in operation prior to the war, and are in the nature of a gradual and permanent change in the economic conditions of the country rather than of a temporary embarrassment. The old order is yielding place to the new in agriculture in the Transvaal, as in other things ; and the farmers are having to accommodate themselves to altered circumstances ; always a difficult and disagreeable task, particularly to the older generation.

The interest which is being taken in new crops, in improved methods of farming, and in good stock, and the support which is being accorded to the Department, coupled with the readiness with which farmers are co-operating with it, in anything which they consider calculated to advance their interests, are hopeful signs however, and judging from these and other indications, it would appear that we are on the eve of a decided advance in the art of agriculture, and that before long the difficulties and reproaches under which the industry now labours will be removed, and that it will be placed upon a far sounder footing than it has yet been.

VETERINARY HYGIENIC PRINCIPLES APPLICABLE TO STOCK IN SOUTH AFRICA.

By Dr. Arnold Theiler, Government Veterinary Bacteriologist,
AND
C. E. Gray, M.R.C.V.S., Principal Veterinary Surgeon.

(*Continued.*)

Diseases of Stock not referred to in the Contagious Diseases of Animals Act.

(2.) DISEASES OF BOVINES.

Gall Sickness.

THE term gall sickness, or black gall sickness, is a South African expression meaning a disease in which there is a derangement of the bile, consisting of either—(1) an enormous distention of the gall bladder, (2) of the discolouration of the bile, or (3) of a change in the consistency of the bile—the latter term being generally applied to those cases in which the bile is of a very dark colour.

We often hear of gall sickness, and the expression is most frequently used in connection with diseases of cattle, and we might, therefore, identify gall sickness with almost every disease encountered in our South African experience. For instance, when rinderpest broke out for the first time some farmers called this disease simply gall sickness, whilst others called it black gall sickness, and, in each case, the unseasonable burning of the veld was believed to be the cause.

The same term was used to describe cases of redwater occurring amongst cattle imported from the Cape or from abroad, when the symptom so commonly associated with that disease—the passing of red urine—was absent; when East Coast fever first appeared in this sub-continent, the name gall sickness was applied to it, and the cause was also attributed to unseasonable burning of the veld.

We have also noticed that cattle transported from the high veld into the bush veld occasionally sicken of a disease which we have proved to be heartwater, but, when the primary lesion of heartwater—that is to say the distention of the heart-bag with fluid—is absent, then the disease is called gall sickness.

Again, in other instances, we have observed changes of the bile due to vegetable poisoning, probably caused by various toxic plants, cases of this sort are also termed gall sickness.

We are, consequently, unable to state definitely which disease was originally termed gall sickness. Indeed, we could enumerate several

other non-fatal ailments of cattle to which the same name is given. It, therefore, appears that gall sickness is a term for anything and everything which is not familiar to the layman; nevertheless, it is extremely probable that there is a specific disease which was originally termed gall sickness, and when we remember that this term was used in South Africa long before redwater was noticed in the early seventies of last century, and before rinderpest and East Coast fever had made their appearance, and, further, that the same term is used in parts of South Africa where these latter diseases are still absent, we must conclude that there is a special disease to which this name was first applied; that this disease is still present, and that it is quite distinct from redwater, but it is evident that it must have some resemblance to all these diseases, especially to the latter one, with which it was first, and is now, still confounded. This, together with the knowledge that a layman understands, namely, that a derangement of the gall bladder and the bile are the principal lesions of the disease affords us a clue as to its identity.

Discolouration of the bile may be due, in the first place, to some alteration of the liver. We know that, as a rule, this is the case in which destruction of the red blood corpuscles has taken place. For instance, in any disease caused by blood parasites when a certain number of red blood corpuscles are destroyed, the discoloured matter of the red corpuscles is retained by the liver, and it is one of the functions of the liver to dispose of this coloured matter by changing it into bile. When the breakdown is of a considerable extent, an increase of secretion of bile naturally follows, which is discharged into the gall bladder, and if this overproduction is not discharged into the intestines it causes a distention of the gall bladder, and the discolouring of all the tissues which come in contact with the gall bladder. The overproduction of the bile may cause a secondary irritation of the mucous membranes of this organ, which, in its turn, causes abnormal viscidity of the bile.

The problem presented to the South African Veterinary Pathologist which requires an answer is—If the term gall sickness is neither appropriate to redwater or to rinderpest, what is the old-established disease to which this name was first applied? And, for the solution of this problem, our recent investigations regarding redwater afford a clue, as we have found in the blood of South African cattle a certain blood parasite which we were inclined at first to identify with the redwater parasite, but which we have lately been able to separate from it, and we believe that to the disease produced by this parasite the term gall sickness was originally applied.

In many respects this disease closely resembles ordinary redwater, inasmuch as the organism, to which the nume of piroplasma mutans has been applied, belongs to the same class of parasites, and is, in all likelihood, a tick communicated disease, although it is not communicated by the tick which is responsible for the dissemination of ordinary redwater.

This disease has an incubation period of from 25 to 40 days, whereas that of ordinary redwater is from 10 to 14 days, and, although the lesions produced thereby resemble closely those of ordinary redwater, no pure and uncomplicated case of the disease has yet been produced in which red urine has been observed to occur, the *post-mortem* appearances being those generally looked upon as typical of gall sickness.

We have noticed, however, that young animals do not die of this disease; they contract it when exposed to infection and recover.

This disease probably belongs to that class termed "acclimatisation diseases" which young or imported cattle have to pass through, although, in the majority of cases, the illness passes unnoticed. We are not in a position to give any advice as to a specific treatment of this disease caused by the new piroplasma, but, considering its effects upon the blood and liver, purgatives like glaubers salts, which have a stimulating action on the liver, would probably have the most beneficial effect.

From a prophylactic point of view it must be borne in mind that animals which have passed through this disease are immune against future attacks; therefore, it is advisable to see that the calves are exposed to veld infection whilst they are young. They will then contract it, easily recover, and remain immune.

We have also some reason to believe that it will be possible to inoculate against this disease somewhat in the same way as redwater, but we are not in a position to say to what extent. The danger would be for imported cattle, or cattle bred on the high veld. We have only noticed, so far, that Africander cattle born in other parts of the country can be inoculated with safety as long as they are not too old.

Looking for another cause which may be responsible for the lesions similar to those described as characteristic of gall sickness, it may be noted that such lesions may arise directly from a simple inflammation of the intestines, such as may occur in cases of poisoning, or, as the case of a specific disease like heartwater or East Coast fever, by extension of the inflammatory process from the intestine to the bile duct and gall bladder, causing blocking of the former and an abnormal secretion of mucous in the latter, leading to distention of the gall bladder by thick viscid bile. Should the congestion and over distention of the gall bladder be the result of a simple congestion of the intestines, almost any medicine which serves to clear out the stomach and duodenum causes improvement. Therefore, many remedies are given with beneficial results in cases of so-called gall sickness where the abnormal condition of the gall bladder is not caused by the poison of any specific disease.

An examination of blood smears taken from animals supposed to be suffering from gall sickness will materially assist us in coming to a conclusion as to what some of these cases are due to, and the public are invited to send such smears to the Bacteriologist, Bacteriological Laboratory, P.O. Box 593, Pretoria, for examination.

SPONZIEKTE.

(*Black Quarter or Quarter Evil.*)

This disease principally attacks young cattle about one or two years old. It is general knowledge that calves, as long as they are sucking, do not contract it at all, and that animals above three years of age are rarely found to suffer. It is also noticed that animals contract the disease when the grass is luxuriant, and while the animals are quickly growing; therefore, it has been the general idea that the disease is caused by rapid growth and excess of food. We know scientifically, however, that this is not the cause of the disease, but that it is due to infection by a certain bacterium which enters the body and develops in the subcutaneous or muscular tissues. An offensive gas with an offensive odour is evolved by the organism during the progress of the disease in the tissues of the affected part and the animal dies, probably as a result of absorption of toxic products formed by the organism causing the disease. This organism is very closely allied to fermentive bacterium of the butyric acid group which only lives and multiplies in situations in which it is protected from the oxygen of the air.

The disease occurs practically all over the world, and the bacterium may be present in the ground in places in which the disease has never been known to make its appearance, as it is probably one of those organisms which can exist and multiply independently of the animal in which it gives rise to the disease known as sponziekte.

It is not yet certain how this microbe enters the body—certainly, in some instances, it does so through the skin, but, in the majority of cases, no evidence of external injury remains, and it is probable that the microbe enters the system through the alimentary canal and circulates in the blood, and, when some rupture of the muscle has accidentally taken place, finds the best condition for its development in the hæmorrhages associated with such rupture.

Once the disease has broken out on a farm it is almost certain that, sooner or later, fresh outbreaks will occur. Certain places on such farms become infected more than another, and if carcases of an infected animal are left lying on the ground, the spot where it has lain is certain to become seriously contaminated by the spores of the bacillus which retain their vitality for years; therefore, it is advisable to bury deep, or burn, all animals which die from this disease, and it is unwise to cut them open or to make any incision into the swelling, so that the soil does not become contaminated.

Susceptible animals running on an infected farm should be kept away from such spots which are known to be contaminated, that is to say, from the places where animals which have suffered from sponziekte have been buried.

We are fortunately in the position to prevent this disease by a simple method of inoculation which consists in an injection of vaccine prepared from the muscular tissue of an animal suffering from

sponziekte which has been exposed to a certain degree of heat for the purpose of attenuating the virulence of the organism—this inoculation affords immunity for a year, consequently all young animals, one and two years old, should be injected annually for the first two years.

Application for this vaccine should be made to the Bacteriological Laboratory, P.O. Box 593, Pretoria, at any time of the year, and the vaccine, together with the necessary directions, will be despatched direct. In order to cover the cost of preparation, a nominal charge of 3d. per dose is made.

Epizootic Abortion.

Epizootic abortion has not been noticed amongst South African cattle to the same extent as it is found in other parts of the world, for instance, England and the European Continent.

The disease is due to a bacterium, discovered by Professor Bang, of Copenhagen, which is found between the foetal envelopes and the mucous membrane of the uterus, where its presence sets up a slight metritis, *i.e.*, an inflammation of the uterus. According to Bang, this bacterium is not only found in the mucous membrane of the uterus, where it causes an odourless exudate of a dirty yellow colour and of pultaceous character, but also in the envelopes and in the fœtus itself.

Bang has proved that the propagation of this disease may take place either by infection through the womb or through the alimentary canal. In the first instance, it is the bull which propagates the infection. It has been found that when a bull is covering a cow which has suffered from this disease he may be contaminated with the bacterium and communicate it to all the other cows and heifers which he covers. Animals may also become infected by eating food which has been contaminated by the discharge of an infected cow. The bacterium of this disease retains its power of infection for about seven months, so that once the infection is introduced on to a place it may remain there for some considerable time, and cows which have aborted are the usual medium for perpetuating infection, because, as long as the metritis is present baccilli will constantly be discharged and the surroundings of that particular animal consequently become contaminated.

In order to prevent the introduction of epizootic abortion into a herd it is necessary to follow certain rules when introducing pregnant animals into a clean herd, and newly-purchased pregnant cows whose origin is not exactly known should not be immediately placed amongst the herd, but should be kept separate and watched carefully until after the first calving, as it is not unusual in this country and in other countries in which there is no legislation introduced dealing with this disease for people who have contagious abortion in their stables to sell off their contaminated stock, and, in this way, infection is spread far and wide. Steps should also be taken in all cases where cows are sent

to bulls for service to make certain that the bull does not belong to a herd in which contagious abortion is known to exist.

Should the disease make its appearance in a herd every possible precaution must be immediately taken to isolate the animal. The fœtal envelopes and the fœtus should be destroyed by fire, and in cases where the after-birth is not discharged, it should be removed. The womb, uterus and everything which has been in connection with the particular cow should be thoroughly disinfected, so that the operator's hands or boots cannot carry the infection. A cow which has aborted should not be brought to a bull until all symptoms of the previous abortion have ceased, and very frequent washings with antiseptics are required to attain this.

It usually happens that cows which have aborted once will continue to abort a second and, occasionally, a third time, but in process of time a certain amount of immunity becomes established in infected animals, and, if this is the case, the infection usually dies out and the herd becomes quite clean again. From an economical point of view it is not wise when the disease breaks out in a herd to get rid of all animals as they become sick and introduce others into their places, because these latter will, as a rule, also become infected and thereby maintain the infection in the same stable, whereas animals which have aborted, and, as stated, acquire a certain amount of immunity, will prove, after a lapse of two to three years, refractory to the new infection and the disease will die out.

By observation of the precautions indicated, in the event of the disease making its appearance in a herd, the disease can be stamped out, but the process is very often a tedious one, and, since contagious abortion has not taken a very strong hold in this country, the idea suggests itself as to whether it would not be advisable to take legislative measures to prevent indiscriminate importation of cattle affected with contagious abortion. For instance, the importation from oversea could be made dependent on a certificate that the animal did not belong to a herd in which, for at least the last three years, no outbreaks of this disease have occurred, while, on the other hand, provision should be made that the disease is not scattered from the already existing centres by the sale of infected animals.

Stijfziekte and Lamziektè.

The western part of the Transvaal and various places in the high veld appear to be the chief districts where this disease is present. It is not always observed to the same extent, but it seems to vary according to climatic conditions—for instance during, and after, a severe and prolonged drought it is always more prevalent, and then the outbreak is inclined to extend over larger areas. It principally attacks cattle, preferably cows heavy in calf or in milk, but young cattle are also noticed to occasionally contract it, whereas oxen are

generally unaffected. The disease is most common when the grass is the least nourishing, *i.e.*, from the end of the winter season until the commencement of summer, although cases have been reported all the year round. Sheep and goats are also said to suffer, and even horses, but not to the same extent as cattle.

It has frequently been noticed that, on a farm where stijfziekte and lamziekte is present, cattle are observed to have an uncommon craving for bones and other animal matter. Knowledge of this fact and consideration of the *post-mortem* lesions of affected animals suggest that the disease is due to defective nutrition of bone matter. *Post-mortem* examinations of animals affected with stijfziekte show that the joints and the pedal bones become greatly congested and inflamed; there are also pathological lesions closely resembling ring bones and laminitis in the horse. The cancellated tissue of the bones of the fore legs become acutely congested; the pelvic and thigh bones are similarly affected, and the whole skeleton becomes softer.

The particular material which is wanting is phosphate of lime, and it has been noticed that a fair allowance of bone meal—which contains the necessary salts—and an improvement in the quality of the food is usually accompanied with a change for the better, and also helps to prevent the disease.

As evidence against the theory that the disease is dietetic and due to a deficiency in phosphates, it has frequently been pointed out that although oxen partake of the same food as cows yet they very rarely contract the disease, but it must be borne in mind that the drain upon the bone-forming constituents in the blood is heaviest in cows in calf or in milk, and this occasions a large loss of phosphatic salts, which is not maintained by the food. In addition to this, another explanation may be given, namely, that oxen are working, and whilst they are so doing the tissue changes in the muscle and other organs is greatly increased, and one of the substances formed, as a result of muscular activity, is phosphoric acid, which probably combines with the lime which is always present in the food, forming the special salt required, namely, phosphate of lime.

Lamziekte has been thought to be due to the same cause as stijfziekte, although the two diseases differ considerably in symptoms and character, because they have been observed, more or less, to the same extent, under similar conditions, and on the same grass and veld.

Lamziekte is characterised by a congestion of the vertebral column as a serious infusion in the spinal canal takes place, and abnormal changes in the large bones of the limbs and the articular surface. We are not in a position to express an opinion in this matter based on personal observation.

We should like to draw the attention of farmers to the fact that a report on cases of stijfziekte and lamziekte, whenever an outbreak occurs, would prove of considerable assistance to us in order to pursue further investigations.

(3) DISEASES OF SHEEP AND GOATS.

Heartwater.

This is a specific disease which, as far as we are aware, is indigenous to South Africa, and, as yet, we have only heard of heartwater in Natal and in certain parts of the Transvaal and Cape Colony.

Heartwater is due to a micro-organism living in the blood, but the parasite is invisible, and, as is the case in horse sickness and blue tongue, we are unable to cultivate it on the artificial media in the same way that we can cultivate the germs of the majority of other diseases.

Heartwater attacks all domestic ruminants, but we speak more particularly of it in sheep and goats as it is more commonly a cause of loss in these animals than in cattle. In the case of goats, Angoras seem to contract it more easily than the common Africander goat, bred in the bush veld, which is better able to resist it. Amongst sheep, the Merino is the heaviest sufferer; the Africander comes next with slightly less resistance, but Persian sheep, although they can be infected with heartwater, very rarely die of it. This is a noteworthy point of practical value.

Recent investigations by Mr. Lounsbery, Government Entomologist, Cape Colony, have served to show the manner in which the disease is spread—the responsible agent being the bont or tortoise-shell tick. This tick requires in its life-cycle three hosts, namely: (1) during its larval stage, (2) nymphal and (3) adult stage, and if infected during either the larval or nymphal stage it is capable of infecting a susceptible animal in either the nymphal or adult stage, but it does not transmit the disease through the egg to its progeny, thereby resembling the propagating agent of East Coast fever, and differing from that of ordinary redwater.

A further point of importance is that an animal which has recovered from heartwater is no longer infective, which is not usually the case with most tick-communicated diseases in which the blood remains infective for a very long time after the animal has got over the acute attack.

The time necessary for the completion of the life-cycle of this tick is about two years. Therefore, an infected veld may be expected to remain infected for at least that length of time. The disease is more likely to establish itself permanently in low, bushy, and warm country, and not in high, bare and cold districts where the conditions are unfavourable for its development.

Although we know the real agent of the propagation of heartwater, yet, at the present time, we are not in a position to recommend any simple preventive treatment. The destruction of the bont tick would, of course, mean the eradication of heartwater, but, as we noted that it takes about two years before the life-history of this particular tick is finished, it would, therefore, be necessary to keep up the

periodic dipping for a very considerable length of time before we can hope to eradicate the insect. This procedure is possible on fenced-in farms, and likely to prove successful, because we have noted animals which have recovered from heartwater are no longer capable of carrying the disease, and by turning immune animals—for preference oxen—into a heartwater field, they would pick up the ticks, which could be killed off by periodical dipping, so that we would eventually arrive at the final eradication of the tick. In the Cape Colony, where whole strips of that country have become almost useless for sheep-breeding on account of heartwater, similar experiments have been made, and, as far as we are aware, with beneficial results.

Certain districts of the Transvaal are also unfit for sheep and goat breeding for the same reason, but we are somewhat reluctant to advise adoption of the foregoing preventive measures on account of the large expense which such a course would entail, and we are of the opinion that in this country, under such conditions, where ordinary sheep and goats do not thrive for this reason, their place should be taken by Persians, which thrive in localities where it is impossible to keep ordinary sheep and goats on account of the prevalence of heartwater.

The problem of introducing a safe and satisfactory method of immunising ordinary sheep and goats against heartwater is still unsolved, and is likely to be a difficult one as the virus of heartwater does not retain its virulency for more than about 48 hours, and this will probably prove one of the stumbling blocks in heartwater inoculation. The principle of the method has been solved, as it is possible to produce a serum which has protective powers. This has been done by immunising cattle with virus of cattle, sheep with virus of sheep, and goats with virus of goats. We have already noted that various strains of heartwater exist, but which do not all immunise one against the other, so that before a successful inoculation can be of practical value, various points have to be elucidated.

Blue Tongue.

This disease resembles horse sickness in many respects, but, although many farmers consider both diseases as identical, experiments have proved that such is not the case, as sheep do not develop blue tongue when injected with horse sickness virus, neither can horses be infected with horse sickness by inoculating them with blood taken from sheep suffering from blue tongue.

It may also be pointed out that blue tongue is found in a higher altitude than horse sickness, so that the carrier which acts as an intermediate host is probably different, although our knowledge concerning the appearance, disappearance and propagation of blue tongue makes it evident that this disease, like horse sickness, is carried by a biting insect. Knowledge of this fact suggests that the protection of sheep from attack by this insect should suffice to ward off attacks

of the disease, and it has been noted that the higher and drier the sheep are kept, the further they are removed from any pan, vlei or collection of water, the safer they are. On some farms such precautions cannot be followed, and it would, therefore, be desirable to devise a method of inoculation which would insure a certain amount of immunity against a natural attack, and this we have succeeded in accomplishing by the preparation of a vaccine, having noted in our experiments that virus after passing through a number of sheep becomes greatly attenuated, that is to say, it produces a typical blue tongue temperature reaction, but accompanied with either no symptoms or of only to such a slight degree that they are hardly noticed. It now remains to be seen whether this vaccine will protect an animal against natural infection, although to the same extent that a naturally contracted attack does, we have some reason to hope that it will, and that the immunity will be more or less permanent, as we have found that, as a general rule, one attack of blue tongue immunises against subsequent infection, although we certainly noticed that when young animals, which had previously suffered from blue tongue, were injected with large quantities of virus they then passed through a second attack. From this observation we may infer that a similar occurrence will take place in practice. In other words the majority of animals inoculated will be protected, whilst a small percentage will break down, but experience alone will show us to what extent these relapses will take place as it has done in the case of inoculation against horse sickness.

The vaccine of which we have spoken has been introduced into practice this year for the first time after having had a thorough test in the Bacteriological Laboratory, where the results proved that no deaths from blue tongue were due to the result of the inoculation of vaccine. It must be remembered that a great deal of care must be taken in the inoculation, because it recently happened in two instances that the virus became contaminated and produced an unfortunate mortality, from which we have learned that if the inoculation is carried out during a rainy day, or if the sheep are turned into muddy kraals after the injection, infection of the inoculation site may follow with fatal results, and we have, therefore, considered it advisable to issue vaccine this season through the District Veterinary Surgeons, who will give all the instructions and an ocular demonstration of the manner in which the inoculation should be carried out.

Gijlziekte.

Gijlziekte is principally spoken of in sheep all over South Africa, and is chiefly prevalent at the time when the new grass is most luxuriant and while the young animals are growing quickly. These two observations have been regarded by laymen as the probable cause of the disease, but although the observation is correct it is capable of a different interpretation. We consider gijlziekte as probably due to

abnormal fermentative changes in the first stomach, and it is probable that young grass contains the necessary fermenting material in the most suitable form for the development of certain micro-organisms which cause this fermentation, with an attendant evolution of gas, which, either by pressure on the lungs or by absorption into the blood, causes the death of the sheep. But whether the micro-organism in question is an ordinary fermenting bacterium or a yeast, and whether it is, or is not, specific is, as yet, unsettled.

For this disorder, practical experience in South Africa has found a remedy which certainly has a scientific base, and it is common knowledge that Cooper's Dip is a useful and valuable preventive. This dip is a combination of arsenic and sulphur, and one teaspoonful of a mixture in the proportion of 1 part Cooper's Dip to 9 parts salt is usually given as a prophylactic and it probably prevents the disease, on account of the arsenic being retained in the rumen of an animal for a considerable length of time before it is dissolved and exercising an anti-fermentative action preventing the multiplication of the micro-organism and in this way protecting against gijlziekte.

Geel Dikkop.

Long droughts, followed by heavy rains and succeeded by hot weather, are the chief climatic conditions which are responsible for this sheep disease. Flocks after grazing in low-lying velds and vleis under these conditions, and subsequently removed to other spots, occasionally sicken of geel dikkop. It is observed in various parts of the country, but it does not play a very important rôle as an epidemic disease, and may be noted more or less according to the climatic conditions of the particular year. In its etiology it has some analogy with such diseases as blue tongue and horse sickness. We are of opinion that the disease belongs to a group which is of malarial character, and which we have mentioned before requires an intermediate host for its propagation. It follows that an outbreak can be checked by moving the diseased flocks to higher altitudes, and by observing the same precautions as are carried out in horse sickness and blue tongue —that is not to allow them to graze on the grass between about two hours before sunset until a corresponding time after sunrise.

Many causes have been considered as responsible for this disease, and especially plants, the dubbeltje doorn being specially mentioned, but feeding experiments do not bear out this opinion.

This disease also requires further investigation, and we again appeal to farmers to report any cases of this disease for further experiments.

Jagziekte, or Chronic Pneumonia of Sheep.

This is another disease of sheep affecting the lungs, and most common during the winter months. So far, we only know of jagziekte in the western part of the Transvaal, but it has occasionally been

reported in the high veld. It is thought that it has some connection with cold and wet, appearing especially during the winter months, but there is every reason to believe that, in addition to this, another condition is required, although, so far, this has not been traced.

Jagziekte is a pneumonia—that is, an inflammation of the lungs, but of peculiar character. The affected part becomes quite solid, of a dark colour, firm and friable. In advanced cases, the ordinary lung tissue is replaced by a fibrous growth, which cuts like cartilage. There is a distinct line of demarcation between the healthy and the completely consolidated parts of the affected lung.

The cause of jagziekte is not yet known, but, as there appears to be some reason to believe that it is infectious, it would be advisable to isolate an animal suffering from this disease, or, better still, to destroy it immediately.

This disease requires further investigation, and we would ask farmers to kindly communicate with us whenever a case of jagziekte occurs on their farms.

(To be Continued.)

NOTES ON THE SABI GAME RESERVE.

By Major J. Stevenson Hamilton,
Warden, Government Game Reserves.

No. II.

THE Impala, also known as the Pallah, or Rooibok, may claim to be one of the most beautiful and graceful of our existing wild fauna, and is still fortunately to be found in considerable numbers in the wilder and more wooded regions of the Transvaal. Given its scientific name, *Aepyceros melampus*, by the celebrated traveller and naturalist Lichtenstein, more than a hundred years ago, this animal has often been called the Springbok of the low veld, and in its extraordinary leaping powers equals and possibly even surpasses its high veld cousin. Its general colour is a bright chestnut, paling to a delicate fawn along the sides, and pure white below; the limbs are clean and slender, the hind legs having attached to the lower and hinder parts of the cannon bones a very distinctive brush of dark brown hairs surrounding a gland containing an oily secretion. On either side of the tail extends a narrow elliptical line of dark colour, similar, except in colour, to that seen in the Common Waterbuck (*Cobus Ellipsiprymnus*). Nature's purpose in providing this line may probably be to facilitate each animal following its leader when dashing at full speed and in single file through thick bush when alarmed or pursued by some natural enemy

The average height at the withers of the males is some 34 inches, and the latter are distinguished by their beautiful lyre shaped horns, which with us sometimes reach a length round the curve of 24 or 25 inches, while in East Africa they often attain a length of 5 or 6 inches in excess of this. In Northern Rhodesia on the other hand the heads are generally of smaller dimensions. It is difficult to form any idea why this local variety in size should tend to occur amongst certain species of game; it might be put down to the influence of climate, but in this case one would imagine that it would affect all animals similarly in their relative degrees of size, whereas some other East African species are found to carry heads of lesser, and certain Rhodesian species of greater, dimensions than do the same types with us. No doubt some local influence governs such matters, as the Impalas found on the slopes of the Lebombo Hills, and generally on stony ridges seem to attain, as regards their horns, to a greater size than do those of the flat bush country. The females are hornless, and luckily for the species greatly exceed the males in number.

There is no prettier sight than a troop of Impalas feeding, when they fancy themselves unobserved, in some open glade of their favourite bush. The rams, dotted here and there amongst the preponderating numbers

of the other sex, pick their way daintily along, with heads erect, chests puffed out, a general conscious superiority characterising their bearing. The ewes, ever wary and alert for danger, glance constantly around in the intervals of feeding; sometimes an electric thrill seems to run through the whole troop; a ewe starts at some imaginary danger, and instantly every other member thrills in sympathy, every bright eye is fixed, and every delicate ear pointed towards the suspected quarter; a moment of suspense and the whole settle down again as if nothing had occurred to cause temporary alarm. This watchfulness of the Impala is peculiarly noticeable when they are drinking; during the dry months, towards the end of the winter especially, the herds congregate in the vicinity of the perennial streams, from the waters of which they satisfy their thirst some three times a day, never, if undisturbed, moving far from the banks in the intervals of drinking. At this time of year it is not a difficult matter to conceal oneself in such a manner and with such regard for the prevailing breeze, as to be enabled to study the watering of a herd at very close quarters. One then forcibly realizes the dangers which must constantly threaten the wild denizens of the bush, and how their existence must be conditional on their watchfulness.

A large herd may be seen slowly approaching the water, stopping occasionally to nibble the tops of the young reeds, or to pluck a mouthful of tempting herbage; on nearing the drinking place, the majority spread themselves along the bank, some grazing, some resting in the shade, while a few old and experienced ewes keep a sharp look out towards the bush which they have just left. Then a detachment of a dozen or so rapidly come down to drink: these will be mostly ewes and young rams whose horns have not yet attained the lyrate curve of maturity. Mark how each animal stands as far back from the water as is consistent with being able to touch the surface with the extremity of its nozzle; the weight is thrown back on the hindquarters; every muscle is braced for an instantaneous spring. Their enemies dwell in the water as well as on dry land, as the contents of many an evil old crocodile's stomach attest Hardly have the heads been lowered, when there is a quick snort of alarm, and in a moment every Impala is a dozen feet from the water, every sense strained to the utmost; then cautiously once more they approach, a few anxious sips, and they depart at the same rapid walk at which they came, while another detachment takes their place: and so it goes on until all have satisfied their thirst, an old ram, the patriarch of the herd, being usually the last to leave, standing and staring steadily backwards for a few moments before leisurely joining the remainder. On the whole the males, perhaps because they are accustomed to a great extent to rely upon female wit to warn them of danger, betray less nervousness while drinking than do members of the other sex. And now an old ewe catches sight of something which alarms her, or inhales a whiff of tainted air; instantly she turns rigid as a statue, the personification of passive alertness; the danger evidently approaches, and she utters a loud snort quite distinctive of the alarmed Impala, and formed by expelling the air sharply through the nostrils, in a note shriller and higher than the deep base of the large antelopes. As each member of the herd gets the wind, or sight, of the cause of alarm, he

or she too joins in the chorus till the welkin rings; then suddenly, as if by word of command, the whole herd swerves round, and the members make off with mighty bounds, clearing bushes, rocks, and ravines in their flight, and disappear into the bush, just as a couple of natives round the corner of the path.

It has been customary to catch a few of these antelopes alive each winter, the *modus operandi* being to stretch a hundred yards of deer netting along the edge of the bush, and some 50 yards from a favourite drinking place; after a few days, when the Impala have become used to the sight of the strange object, watchers suddenly appear from their ambush and the herd dashes straight for the net; of course, those not too alarmed to remember its presence, can get round one end or the other, but those who see it too late for this always jump for it, and when it is recollected that the net is 12 feet high when drawn tight, and seldom if ever sags down below a level of 10 feet, no higher tribute to the leaping powers of the Impala is required than the fact that 90 per cent. clear the whole thing with plenty to spare, while the measurement from take-off to landing is something surprising, and would turn many a fine steeplechase horse green with envy, though the Impala measures but 8½ hands, while the other may attain to twice that height. Those caught are the unfortunates who either do not see the treacherous obstacle till too late, or fancy that they can dash through it. The antelope seems to sail through the air without effort, with none of the visible energy expended in a horse's leap. He leaves the ground frequently from a stand, describes a great parabola, and lands again light as a feather. In taking these leaps, the forelegs are gathered up under the body, and close to it, but the hind ones, on the contrary, are extended at full length behind the animal. A clever hunter will always tuck his hind legs under him when negotiating an obstacle, and they are the first to touch the ground again. But with the Impala the contrary is the case. There is a distinct "dwell" between each bound, which is of an undulating nature, and quite different from the india-rubber-ball-like action characteristic of the Springbok.

When pursued the Impala is capable of moving at a great pace, and the manner in which he gets through the densest bush without decreasing it is wonderful, but it is, owing to his habits, a difficult matter to estimate his relative speed over a considerable distance in open country. Sometimes, during the heat of the day, a herd may be discovered resting under the shade of some large tree near the river bank; at such times the rams esp.cially will often dash round and round in circles, pursuing each other in play, and on these occasions they always elevate their tails, a habit which at a distance makes them look rather like Reedbuck. Full grown ewes, and young rams up to at least a year old, soon become tame in captivity, and at the end of a couple of weeks will readily accept food from the hand through the enclosure fence. One ram of about 10 months old would jump backwards and forwards over a stick held out in front of him, the height of which was gradually raised, until he would take the leap at the height of a man's arm. Old rams on the contrary do not, when captured, become readily reconciled to the new conditions, and often savagely attack their companions in captivity. On the morning following the capture o

a full grown male, he was found to have both gored and trampled the two young rams and the ewe confined in the same enclosure. All capturing of wild animals must be attended with a certain amount of waste of life, however carefully precautions are taken to guard against it, and all that can be done is to reduce that inevitable waste to as small dimensions as possible. When a full grown animal has to be conveyed from the place of capture to the prepared enclosure, care should be taken that the head is not allowed to hang down, or the cud will choke him.

Impala lambs are born from the end of October to the end of November, the time varying a few days according to the lateness or otherwise of the season. When the lamb is about to be born the mother leaves the herd, and chooses a bit of very thick bush, where she may be seen, standing looking anxiously about, while the young one after its birth frisks gaily around. Lambs seem to be born nearly dry; they are able to stand almost at once, and commence to play about within three hours of birth. Their growth is extraordinarily rapid at this time; within a few days the ewe with her lamb rejoins the herd, and the young one is able to keep up with the others. One lamb only is born at a time, but the young ewes become mothers at the end of their second year. It is believed that they lamb a few weeks before the older animals. During the summer months the females may be seen in troops up to about 40, accompanied by one or two full grown males: the remainder of the latter consort together in parties of from 2 to 8 or 10. From the middle of April to the middle of May is the mating season, and at this time the rams utter a deep gutteral grunt, which is heard everywhere in the bush by night and day, and might easily convince the novice that he was in the vicinity of dangerous carnivorous animals. As in the case of other wild animals, the males contend for the ladies, and many a patriarch past his prime has to give way to some younger and stronger rival, and to content himself for the future with male companionship. Fatal combats, however, are rare. During the winter males and females herd promiscuously together, and this social amity is maintained up to the breeding season, when the unsuccessful males again separate themselves from the herd.

It is during this winter season that great droves of Impala are sometimes seen "turning," as natives say, "the bush red." But this congregation is merely consequent upon the limitation of food and pasturage during the dry months, when the animals are forced to collect in the neighbourhood of the permanent water. It is during the rainy season that one can best study their natural habits, when these habits are dictated by choice, and not imposed by necessity. In the summer, therefore, the Impalas wander far from their winter haunts, and may be found scattered in small bands all over the country, wherever the bush is sufficiently thick and the most eagerly desired herbs abundant. Here a male with his harem, there a band of young rams. At this time the necessity for the regular drinking, which is so characteristic in the dry season, is less pressing. The long grass and herbage of all kinds is frequently soaked with rain, while the heavy nightly dews keep it wet up to nearly mid-day at other times. This moisture in the grass is apparently sufficient for the animals' needs, and their spoor in the neighbourhood of forest pools is seldom evident.

Each troop, however, may be found in its own particular piece of country, which it only leaves when food becomes short, or the time arrives for the annual migration to the river banks. The first day's rain of the summer is a joyous one for the Impala; as the heavy clouds roll up, and the air becomes dense with moisture, the bush for miles is filled with the deep and continuous grunting of the rams, their paean of thanks to beneficent nature. At the descent of the first drop, every buck has left the river, not to be seen in its vicinity again for a period of some seven months. The favourite locale of the species is invariably more or less dense thorn bush, to the shelter of which the animals at once fly if surprised in the open.

The food of Impala is various, and, like many antelopes, he is more partial to browsing than to grazing. His staple diet is the leaves of certain of the acacias, and towards the end of the winter and during the spring he is exceedingly partial to a certain bean pod produced by one of these. This bean pod appears to be exceedingly nourishing and fattening, and when it is in season Impala will hardly look at anything else. The leaf of the common "Wait-a-bit" ("Wacht-een-beetje") is perhaps next in popularity. Grass is eaten at night, especially when young and fresh, in the open glades which are affected at that time as a precaution against sudden surprise. Impala are seldom observed to lie down by day, but it is probable that they do so at night, as animals in captivity are prone to act thus, even when they have been captured full grown, and their habits, so to say, formed. The tops of young reeds are cropped, but perhaps more as a dessert than a substantial meal; for captured buck soon got very thin and weak on them when given in conjunction with grass only, whereas directly free foliage and bean pods were substituted, the improvement in condition was at once apparent.

Perhaps there is no antelope possessed of so many natural enemies, and, therefore, nature has given to the species a remarkable capacity for increase, and to the individuals a rare hardiness and tenacity of life. Where Impala are at all numerous the beasts of prey of all kinds—lions leopards, cheetahs and wild dogs devote their attention almost entirely to them to the great advantage of the larger and rarer antelopes and zebras. At lambing time the hyena and the lynx are ready to do their part, and the wild dog plays untold havoc, as the ewes heavy in lamb and the newly born young can make no effort to escape, which can be of the slightest avail. It is at this important season that the Ranger must be out continually amongst his game, and take heavy toll of its enemies. In a relatively short time the worst of the danger is over, and the young animals can take care of themselves nearly as well as their older companions.

When pursued by its most destructive foe the Wilde Hond or Cape Hunting Dog (the term "dog" is of course a misnomer and misleading, as *Lycaon Pictus* is less nearly related to the true dog than is either the Grey Wolf or the Jackal), the Impala frequently makes for a river, and swims well and strongly, generally by this means ensuring its escape, as its cunning enemy has a very wholesome fear of crocodiles. Its tenacity of life is very considerable. On one occasion a ram was observed apparently caught by its horns in a bush. On being approached it made no effort to move, and was apparently in a dazed condition from having chargep

into the stem of a tree when going at full speed; it was secured and carried without resistance to the cattle kraal, where it lay for three days alive, but in a semi-conscious condition. On the evening of the third day it died, and a post-mortem revealed the fact that the top of the skull was completely shivered into fragments, the two horns with a little piece of bone at the base of each being held in place merely by the skin and membranes. A blow such as this would in all probability have killed a human being on the spot. At another time a ewe was observed running with a herd, feeding and apparently unhampered in her movements, though a great piece of flesh nearly a foot square had been torn from her off side, possibly by the claws of a leopard whose spring may have fallen short.

During the summer months the rams are fat and in splendid condition, while the ewes from the effect of suckling their lambs are poor; but in winter conditions are reversed, the older rams, many of them, being very thin, while the females gradually improve, until the acme of their condition is arrived at on the eve of the lambing season. When not persecuted by man these buck become very tame and full of confidence, but they are never really difficult to approach, and the terrible slaughter which went on during the construction of the Selati Railway, when both white men and Kaffirs armed with guns permeated the bush, and trucks piled high with carcases were sometimes sent down the line, attests at once the ease with which they can be come at, as well as the regenerative powers of the species, that in a few years it should have, in spite of the attacks of carnivora, re-attained to at least something of its old abundance.

ON DROUTH-RESISTANT CROPS.*

By A. M. Ten Eyck,

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DROUTH-RESISTANT crops or crops which are adapted for "dry land farming," may be divided into three quite distinct groups, as follows:—

1. Early maturing crops which grow rapidly and ripen before the available soil moisture is used up, or before the hot, dry weather begins, such as winter wheat and early spring grains.

2. Crops which root deeply and gather their moisture supply from a large volume of soil, such as lucerne and certain grasses.

3. Hardy vigorous growing crops which are able to cease growth when the soil becomes too dry or conditions become too unfavourable and remain in a dormant state until the rain comes, when they make quick use of the favourable conditions, growing rapidly, simply reaching maturity a little later than would have been the case if they had been subject to no unfavourable conditions during the period of growth. These last are the true drouth-resistant crops, such as Kaffir corn, sorghum, buffalo-grass and other native grasses of the Western Plains. The crops which belong to the class last named, as a rule, do not root deeply, but the plants develop an abundant and extensive growth of roots in the surface soil which enables them to take advantage of light rains and to quickly absorb a large part of the water which enters the soil, thus securing a greater supply of water under certain conditions, and allowing less waste by surface evaporation than occurs with a deeper-rooting crop or with crops which make a lesser growth of fibrous roots in the surface soil. It appears also that certain of these crops actually require less water to produce growth than some other crops which are not considered especially drouth-resistant.

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* This paper was read at the meeting of the Co-operative Experiment Association of the Great Plains area, held at Lincoln, Nebraska, June 22nd, 1906, and kindly forwarded by the author.—[Editor, "Agricultural Journal"]

Aside from the character which such crops possess of taking advantage of the conditions under which they grow, these drouth-resistant crops are different in some way from ordinary crops in the quality named above, in that they are able to stop growing during unfavourable weather and soil conditions, renewing their growth again when conditions become favourable. This character in the plant is not well understood. It seems to be a characteristic which has been bred into the plant by continual exposure to the conditions under which it is able to grow. We find that most of the crops adapted for growing on the Western Plains have been imported from foreign countries which have a semi-arid climate similar to the climate of our Western Plains. These crops have been bred and grown for centuries, perhaps, in the countries from which they have been brought, and the character of being drouth-resistant has become a quality of the plant, just as the character of being hardy in a cold climate has become the second nature of certain varieties of fruit and of many crops.

Without doubt, therefore, certain crops are more drouth-resistant than others, but successful "dry-land farming" depends largely upon the character of the soil, the preparation of the seed-bed and the culture which the crop receives. The only soils which may be made to produce crops without irrigation in the semi-arid regions are soils which have great moisture-holding capacity. It takes water to produce drouth-resistant crops as well as to produce crops grown under ordinary conditions, and a thin soil or sub-soil underlaid by a gravelly or coarse sandy sub-soil will produce, if at all, only when water is supplied in sufficient quantity during the period of crop growth; while soil which retains moisture well may produce crops even without much rainfall during the growing season. Professor H. B. Linfield, of the Montana Experiment Station, says on this subject: "I have seen a paying crop grown without irrigation on land ranging from a clayey loam to almost sandy when the sub-soil was not porous." The presence of a large amount of humus in the soil also increases its moisture capacity and its power to retain water, and is an important requisite to insure against the injurious effects of drouth. It is true of the soil in a large part of the West that it is lacking in humus, and, for this reason, its water-holding power is not so great as it might be, resulting often in low yields and crop-failures in an unfavourable season.

In the growth of plants, water is needed in the soil: (1) to dissolve the plant food; (2) to carry the food to the plants and through the plants; (3) it is a food in itself to the plants; (4) a certain

amount of water in the soil is necessary to give the proper texture favourable for the growth of the plant roots; (5) water also acts as a regulator of the temperature of the soil tending to raise the temperature of cold soil by reason of warm rains and to keep down the temperature of the soil during the hot summer weather; (6) the bacteria in the soil which assist in the decay and chemical changes by which the plant food in the soil is made available to plants, thrive and multiply only with a favourable degree of soil moisture, heat and air.

Experiments that have been conducted show that in their growth, plants require a large amount of water. By his experiments in Wisconsin, Prof. F. H. King found that cultivated crops withdrew from the soil during their period of growth from 2.4 to 5.1 inches of water, or 300 to 500 tons of water for every ton of dry matter produced. From his experiments he has determined that one inch of water is required to produce three and one-third bushels of wheat, or that *nine inches of water is sufficient to produce a thirty-bushel wheat crop.* In like manner, one inch of water is equivalent to five bushels of barley, five bushels of oats, or six bushels of corn (mealies). According to his figures it would require only four and one-half inches of water to produce a ton of clover hay, or a four-ton crop of clover hay could be produced by eighteen inches of water. Two inches of water were equivalent to one ton of maize-fodder, and a yield of six tons per acre would require only twelve and one-half inches of water. Professor King's experiments were performed out of doors, but not in the field. The crops were grown in cylinders and were not subject exactly to natural field conditions.

In certain experiments which the writer conducted at the North Dakota Experiment Station in the years 1898-9, it required on an average *fifteen inches of water to produce a thirty-bushel wheat crop,* or one inch of water was equivalent to two bushels of wheat. These results were secured in the field. The moisture content of the soil to a depth of six feet was determined at sowing time and again at harvest time. The loss of water from the soil, plus the rainfall during the period of growth, was the amount of water which was charged to the crop. (See North Dakota Experimental Station Bulletin No. 48.)

At the Kansas Experiment Station a series of field experiments of this character are being conducted with different crops. A summary of the data secured during the past three seasons is given in the following table:—

WATER USED BY DIFFERENT CROPS. AVERAGE FOR THREE SEASONS, 1903-5.

Experiments conducted at Kansas State Experiment Station.

Name of Crop.	Average period of growth	Average water used per day.	Total water used by crop.	Yields per acre	Grain produced by 1 in. water.	Total dry matter produced per acre, including straw or stalks.	Pounds of dry matter produced per acre by 1 in. water.	Fall (Aut'mn) condition,* moisture in first 6 feet of soil after season's cropping.	Fall (Aut'mn) difference in moisture in first 6 feet of soil, compared with corn plot.	Spring condition, moisture in first 6 feet of soil after previous season's cropping.	Spring, difference in moisture in first 6 feet of soil, compared with corn plot.
	days	inches	inches	bushels	bushels	pounds	pounds	per cent.	per cent.	per cent.	per cent.
Wheat (winter)	170†	0·131	22·22	18	0·81	2,399	108	23·81	+0·22	24·18	—0·29
Oats	106	0·190	20·15	32	1·58	3,530	175	23·91	+0·32	23·97	—0·50
Barley	102	0·178	18·20	18	0·99	1,918	105	23·79	+0·20	24·56	+0·09
Emmer	116	0·187	21·69	28	1·30	2,797	129	23·18	—0·11	24·20	—0·27
Flax	102	0·219	22·33	8	0·36	1,954	88	23·48	—0·11	24·36	—0·11
Millet	78	0·214	16·71	—		3,338	199	24·22	+0·63	24·97	+0·50
Sorghum (sowed) ...	110	0·166	18·25	—		10,749	509	23·09	—0·50	24·15	—0·32
Soy Beans...	105	0·152	15·91	14	0·88	1,853	116	24·40	+0·81	25·13	+0·66
Kaffir Corn	116	0·146	16·98	50	2·92	6,811	401	23·03	—0·56	23·65	—0·82
Corn (Maize)	137	0·194	26·64	40	1·50	4,424	163	23·59	0·00	24·47	0·00

* Average for two seasons only, 1904 and 1905. † Three winter months deducted.

The soil upon which these experiments were conducted was rather poor in fertility, which accounts for the low yields, especially noticeable with the small grains. The seasons of 1903 and 1904 were very wet, excessive rains fell, and a considerable part of the water must have been lost by surface drainage. None of the crops lacked for water during these seasons; 1905 was a good average season for the production of all crops. The rainfall during the period of growth of different crops was six to twelve inches less than that for the growing period of the same crops in 1904, and, with the exception of the sorghum, Kaffir corn, and soy beans, which require about the same amount of water each season, it took from three to four inches less water to produce the 1905 crops than was required by the crops of 1903 and 1904. Maize required more water for its production than any other crop, although, compared with the small grains, the maize made good use of the water in the production of dry matter, giving a larger yield per acre than other crops except Kaffir corn and sorghum. Each of the small grain crops required about the same amount of water, but oats produced a larger amount of growth per inch of water used than any other of the small grain crops. Kaffir corn and sorghum not only used less water than the maize and small grains, but the total yield of the crops was greater, and the production of dry matter per inch of water used was two or three times greater than the production of dry matter by any other crop. It appears that sorghum and Kaffir corn not only make better use of the water than other crops, but these crops may be grown in *drier soil* and with *little moisture* produce well where other crops fail.

It will be observed that, as an average for the two or three seasons there was little difference in the total moisture content of the several plots upon which the different crops had been grown. In the fall (autumn) of 1905, after a season when the rainfall was normal, the average percentage of moisture in the first six feet of the soil of the several plots was about the same. The Kaffir corn and sorghum ground has, without exception, shown a little less moisture than the maize plots, both in the fall and in the spring; but the difference is slight, amounting to not more than one-half to three-quarters of an inch of water in six feet of soil. These moisture determinations were made late in the fall or early in the spring. Early in the fall, about the time the crops were harvested, the difference in the moisture content of the soil was greater, as shown by various samples taken on September 28th, 1903. Comparing the soil in each plot to a depth of six feet, the Kaffir corn plot contained 2.88 per cent. less water than the corn plot, while the sorghum ground contained 3.51 per cent. less water than the corn plot. The sorghum and kaffir corn ground was particularly deficient in water in the first two or three feet. It appears that sorghum and Kaffir corn actually left the soil drier in the fall than did the maize, and the results of these experiments indicate that drouth-resistant crops may use a large amount of water and tend to exhaust the supply of moisture stored in the soil to a

greater degree than the crops which are not classed as drouth-resistant. "Dry-land farming" is, therefore, as much a question of *soil culture* or of conserving the soil moisture as of growing drouth-resistant crops.

The Principle "Dry-Land Farming" Crops.

Wheat.—Wheat is the great money-making crop of a large part of the semi-arid West. It is not particularly a drouth-resistant crop, although certain varieties appear to succeed better than others in the dry districts. The hard Red-Turkey or Russian wheat is the type or variety which has proved the hardiest and most productive throughout the western part of the winter wheat belt. In the spring wheat States, the standard sorts grown are Fife and Blue Stem, which are also hard wheats. The durum or macaroni wheat is rapidly coming into use in the North-Western States, and it appears to be hardier and more productive than the ordinary spring wheats. This wheat was introduced from Russia, where it has long been grown in a climate and under conditions similar to those of the western part of the North-Western States. It is decidedly a "dry-land farming" crop, and it is the hope of those interested in introducing this wheat that it may prove successful in districts where the rainfall is not sufficient or too uncertain to grow the common wheat, and thus extend profitable wheat-growing still farther West and into the semi-arid lands of the Mountain States.

At present with the varieties grown, the success of the wheat crop in the West is more largely due to the fact that the crop grows during a part of the year when drouth is least apt to prevail than to the drouth-resistant character of the crop. *But wheat is a deep feeder and a rapid grower.* The plant draws its food and moisture from a large volume of soil and is able to withstand unfavourable weather conditions, yet the crop is often materially injured, and the yield decreased by drouth during almost any period of its growth. By hot winds and adverse weather conditions, a promising crop may be destroyed in a few days. Wheat cannot stop growing and remain dormant during an unfavourable period of growth as does Kaffir corn or sorghum. The grain must finish its growth and mature in a certain period whatever the state of growth may be.

Spring wheat is not well adapted for growing in Kansas, but with sufficient moisture to start it in the fall and with the usual spring rains, winter wheat is a profitable crop even in the western counties of the State, where the annual rainfall does not exceed fifteen to twenty inches. However, the methods of growing the crop are crude, and often the Western farmer plants so many acres that he is unable to farm the land well and the result is a poor crop if the season is at all unfavourable. Some farmers, however, are adopting better methods of culture, and enough good farming has been done to prove that it pays to cultivate and till the land well. At the Pomeroy Model Farm in Graham County, the Campbell System of Culture has been practised for several years. This farm was under the direction of Mr. H. W.

Campbell, the originator of the system, and by his reports he has had remarkable success, producing on the average twice as much wheat per acre on the Pomeroy Farm as the average crop in the surrounding country, with no other treatment to the soil except thorough tillage and cultivation. At the Fort Hays Branch Experiment Station in Ellis County, Kansas, sufficient has been accomplished in the three seasons since the station was established to demonstrate that, in the semi-arid West, "good farming" pays as well or even better than it does in the rich farming States of the Mississippi Valley.

Lucerne.—The second great crop of Central and Western Kansas, and also in some sections of Nebraska, Oklahoma and Texas is alfalfa or lucerne. To be sure, the crop is most successfully grown in those countries in Kansas which have sufficient rainfall to produce good maize crops, and, in fact, the two crops, maize and alfalfa, fit well together both in their relation to the soil and as a combination feed for stock of all kinds. Wherever it thrives well there is no other crop grown which will produce so much forage of so high feeding value as alfalfa. Throughout Central Kansas four cuttings of hay are usually harvested each season, and a total yield of four tons per acre in a season is considered a small crop. As yet, alfalfa is not grown extensively in the western counties of the State, except in localities where irrigation is practised, but the crop is gradually creeping up the river valleys and into the creek bottoms each year, pushing its area of successful culture a little farther west, and it has even succeeded on the uplands in some of the western counties where it was not thought possible to grow it a few years ago.

Alfalfa starts slowly and it is rather difficult, especially in the more unfavourable locations, to get a stand, but when the plants are once established they are extremely hardy, surviving drouth and hot winds more successfully than almost any other crop. During the periods of extreme drouth, lucerne does not grow much; sometimes only one cutting is produced in a season on the uplands in Western Kansas, but the plant, through its deep and extensive root system, is able to get a sufficient supply of water to sustain life, and when rain comes it revives and grows anew. At the Kansas Station alfalfa roots have been traced to a depth of over nine feet (see accompanying plate), while at the Colorado Experiment Station, Dr. Wm. P. Headden has washed out the roots of an old alfalfa plant to a depth of nearly twelve feet. Various reports have been made of finding alfalfa roots at even greater depths. It is, without doubt, one of the deepest rooting plants grown on the farm.

I believe that alfalfa will do more for western agriculture in the next fifty years than all the other crops which farmers may be able to grow in this region. The soil of Western Kansas, and of much of the Western Plains is usually rich in the mineral elements of plant-food, but, as stated before, it is often lacking in humus, which becomes especially noticeable if the land has been farmed continuously to wheat for a few years. By growing alfalfa it is possible to increase the

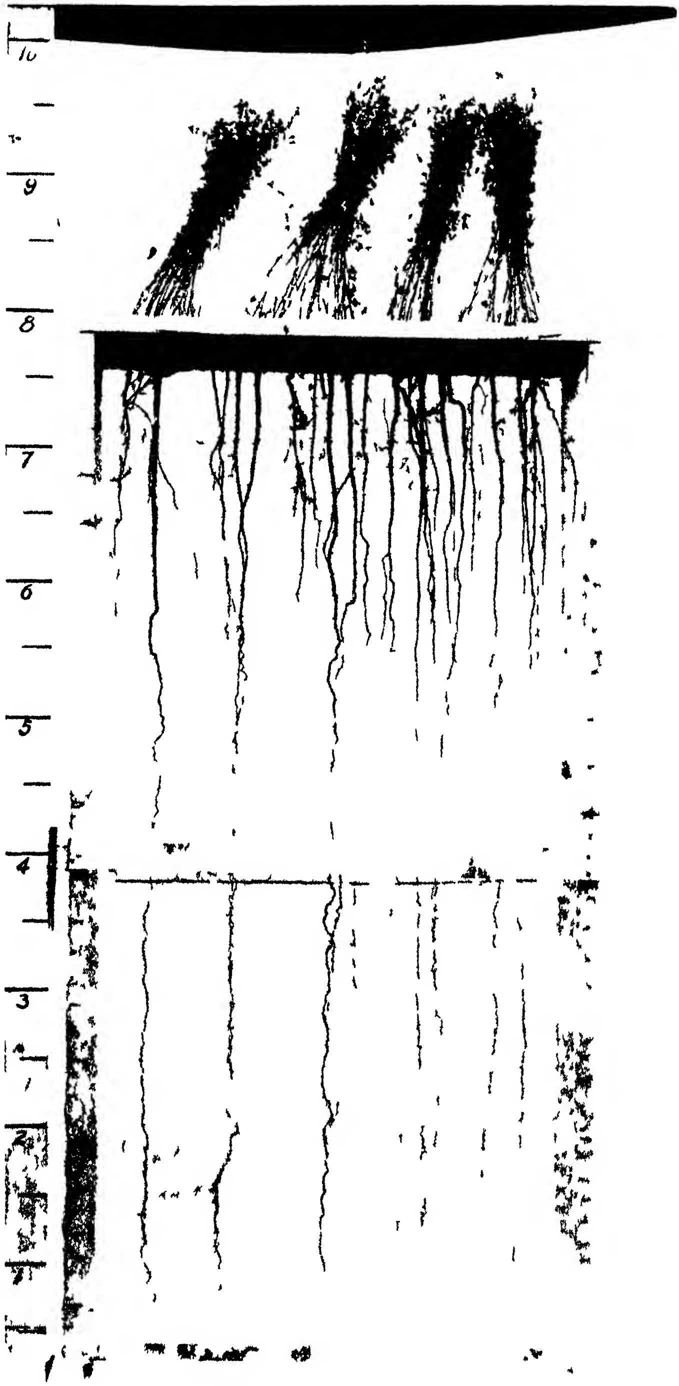


Plate CCVI

The Root System of Lucerne

Five Years after Seeding

(Kansas Agricultural Experiment Station)

supply of humus in the soil, and the roots of the crop penetrating deep into the sub-soil disintegrate and deepen the soil, and all together greatly improve its texture, giving it greater capacity to absorb and hold water. The beneficial effect on the soil of growing alfalfa is only incidental to the rapid introduction of the crop throughout the West. The great value of the crop as a money-maker is the main factor which is introducing it into the agriculture of the great Central West. Where alfalfa can be successfully marketed or fed, no other crop is grown in the West that will yield so great a net profit per acre in a series of years.

Sorghums.—Both the saccharine and non-saccharine sorghums are especially adapted for "dry-land farming," and are well named "drouth-resistant crops." These crops can survive and produce abundantly under conditions of drouth and hot winds that would destroy almost any other crop grown on the Western Plains.

Of the non-saccharine sorghums there are five species or varieties which are grown more or less extensively in different portions of the West. These are Kaffir corn (of which there are two common varieties, the red and the white, or black-hulled white), milo maize, Jerusalem corn, brown dourrha, and African millet. In Kansas, the Kaffir corn is grown most extensively; in the Western part of the State this crop furnishes most of the grain feed and a large part of the roughage for stock. As a forage and grain crop it is superior to maize where the two crops grow equally well, producing more fodder per acre and of a better quality than maize fodder, while the grain is nearly equal to corn in feeding value, and largely takes its place as a feed throughout the region where corn is not extensively grown.

At the Kansas Station, of the varieties named above, Kaffir corn has proved to be the best producer of grain, while milo maize and African millet have given slightly greater yields of fodder than Kaffir corn. The last-named varieties and Jerusalem corn are grown to a limited extent in Western Kansas. In Colorado, the milo maize and brown dourrha (which is similar to Jerusalem corn) are grown more largely than Kaffir corn.

In Kansas, saccharine sorghum, or cane is grown extensively for forage. Usually the seed is sown broadcast, and the crop is cut and put up like hay. There is, perhaps, no forage crop adapted for growing in Kansas that will yield so much forage in a single season as cane, planted as stated above. At the Kansas Station in 1903, 7.7 tons of cured cane fodder per acre was secured at a single cutting, and it is possible in some seasons, by seeding early, to cut two crops in a season.

Both the saccharine and non-saccharine sorghums are much alike in their time of planting, habits of growth, etc. Neither crop will start well in the spring until the soil is warm, and both crops have the capacity of remaining dormant for a considerable period during a drouth and then quickly renewing their growth when the conditions are again favourable. Both crops are great exhausters of the soil moisture, and, perhaps, also of the soil fertility. Kaffir corn, especially,

has gained the reputation of being "hard" on the land. It is the general report that wheat and other crops do not grow so well after Kaffir corn and cane as after maize, and it is claimed that the injurious effects of the sorghum crop on the land may sometimes be observed for several seasons. These reports have not been fully tested at the Kansas Station but from the soil moisture study referred to above, in which cane and Kaffir corn ground was found to be drier in the fall than the maize ground, and, from a study of the root development of the plants, it appears probable that the crops may have the effect on the land which has been reported. The roots of Kaffir corn or cane do not grow so deep into the soil as do those of corn, but make a very extensive and fibrous growth in the surface soil. The crop draws a large part of its moisture and plant-food from the upper soil, and, particularly in a dry season, the surface soil is apt to be left lacking in moisture and available plant-food. If the rainfall is not sufficient to supply the normal amount of moisture before winter sets in, Kaffir corn ground will be deprived of a portion of the loosening benefits of *winter weathering*—the result of the expansion and contraction of the soil by means of the freezing and thawing of the water surrounding the soil grains—and thus the soil may be left in a physical condition unfavourable to the absorption of the spring rains and the development of the roots of the succeeding crops. Also, because Kaffir corn grows late in the fall, it leaves the soil lacking in available plant-food with little opportunity of gaining a sufficient amount to supply the demands of the succeeding crops. The suggestion here is that Kaffir corn should be followed the succeeding year by late-planted crops in order to allow the soil to regain, previous to planting, its normal moisture and fertility.

Broom Corn.—Closely associated with the sorghums, and growing successfully under similar conditions of soil and climate, is broom corn. This crop is rapidly coming into prominence in Western Kansas and in Colorado. In the favourable seasons the crop yields well and is very profitable to grow for the production of the brush which is used in the manufacture of brooms.

Grain Crops.—Other grain crops which may be grown more or less successfully in Western Kansas and Nebraska are emmer, barley, and certain varieties of oats. The new Russian grain, emmer (*Triticum dicoceum*) has proved to be hardy and drouth-resistant, and, at the Kansas Station and other experiment stations in the North-Western States, this grain has given greater yields per acre than barley or oats. However, at the Fort Hays Branch Experiment Station in Kansas, emmer has not proved so hardy and productive as barley or oats. As a feed, emmer will hardly take the place of barley or oats, but it may be ground and fed in combination with these grains or with maize. Wherever barley or oats produce well, emmer is not an especially profitable crop to grow, but in those sections of the West in which the grains above mentioned cannot be successfully grown, emmer may prove to be a profitable crop.

Barley is successfully grown in Kansas farther west than any other spring grain. In fact, barley is produced in larger quantities in the Western Counties of the State than in the Central and Eastern Counties. The counties producing the largest number of bushels in 1900 were as follows: Pawnee, Barton, Ness, Rush, Thomas, Pratt and Hodgeman. Each of these counties produced over 150,000 bushels of barley in the year mentioned.

Another crop that grows successfully in Western Kansas is winter rye. This crop, however, is not grown so extensively as barley, and is apparently a less profitable crop to grow than wheat.

The ordinary varieties of oats are not adapted for "dry-land farming," but, in recent years, a few varieties have been imported from Russia that appear to be hardy and productive in Western Kansas and Nebraska. In Nebraska the Kherson oat is highly recommended by the State Experiment Station as a variety adapted for Western culture. In Kansas the Kherson oats have also proven to be a hardy and productive variety, but, at the Kansas Station, the Sixty Day oats have given somewhat larger yields than the Kherson. Both of these varieties were originally imported from Russia and are early in maturing, producing a rather short growth of straw. Earliness in maturing appears to be a character which is necessary in all grains adapted for growing in the West. The later maturing varieties are more apt to be injured by drouth and hot winds, and often fail to mature plump grain.

Flax is not grown to any extent in Western Kansas, but in Western Nebraska and North and South Dakota it has proved to be one of the most profitable crops. Apparently flax is, in its nature, a drouth-resistant crop. It grows somewhat after the manner of Kaffir corn, making a dense root system in the surface soil, but it is not a deep feeder; and yet it is often considered a "hard" crop on the land, due to the same reasons, no doubt, as have already been discussed for Kaffir corn.

In regions of light rainfall it may not be practicable to attempt to grow a crop every year on the same land. Because of the small amount of rainfall it may be necessary in the semi-arid regions to conserve the moisture of two years in order to insure the harvesting of a crop when the seed is planted. By this method the land is simply fallowed one year and cropped the next. If this practice is followed in the growing of flax, Kaffir corn, cane, etc., the injurious effect of these crops upon the land, which has been observed, will not be so apparent when the soil is given a year in which to regain moisture and develop available plant-food for the succeeding crop.

Grasses.—Formerly the great crop of the Western Plains was grass, and grass is still one of the most important crops of the West. On the hills and uplands, where nothing else will grow, the buffalo-grass thrives, furnishing pasture for great herds of cattle, while in the valleys and more favoured locations, blue-stem and other native prairie grasses grow and produce the thousands of tons of prairie hay annually

harvested in the West, the Kansas crop alone averaging from five to six million tons each year. As a persistent crop, resisting drouth and unfavourable weather conditions, there are no crops to compare with the native grasses of the western prairies, and one of the great problems to be solved by western agriculturists and experiment station men is to train these grasses so that they can be successfully and economically propagated under domestication. Little has yet been done along this line, in fact not one of the native grasses of Kansas has been successfully propagated as a domestic grass.

Of the tame grasses which have been introduced and tried in the West, probably the *Bromus inermis* is superior to all others. This grass has proved to be hardy and productive in Kansas, Nebraska and the Dakotas. It is a great sod producer, and, sending its roots deep into the soil, it is able to withstand severe drouth, by which grasses less adapted to these adverse conditions are destroyed. The writer has washed out samples of *Bromus inermis* roots which extended to a depth of over six feet. During a period of drouth the grass will not grow, but it retains life and makes a renewed growth when the rain comes.

Another grass which is grown successfully in the West is Western rye grass (*Agropyron tenerum*). This grass grows in bunches and is not a sod producer like *Bromus inermis*, but it is hardy and a good drouth-resister.

Another grass adapted for growing in some parts of the West is tall oat grass (*Arrhenatherum avenaceum*). This grass does not form a sod but does well in combination with one of both of the grasses named above. Many of the wild grasses have been grown in a small way at the Kansas Experiment Station, and some have proved promising, but, as a rule, the best of these grasses do not produce seed in sufficient abundance to warrant their introduction as cultivated species.

The fact remains, however, that grass must be included as being an important and necessary crop in Western farming, and one of the problems of the West is to introduce varieties of grass which are hardy, and to learn the methods by which these grasses may be most successfully seeded and established under the unfavourable conditions which often prevail in the region discussed. *Grass is a soil protector, a soil renewer, and a soil builder.* Covering the land with grass is Nature's way of restoring to old worn-out-soil the fertility and good tilth characteristic of virgin soil. The true grasses do not add nitrogen to the soil as do clover and alfalfa, yet they are, in a sense, nitrogen-gatherers in that the nitrogen of the soil is collected and stored up in the roots of the grass in the form of humus. Thus grasses prevent the waste of nitrogen and other plant-food elements and serve to protect the soil and to maintain its fertility. By their extensive and deep penetrating root systems many grasses also tend to break up and deepen the soil, gathering and storing plant-food in their roots and thus actually increasing the available plant-food of the soil.

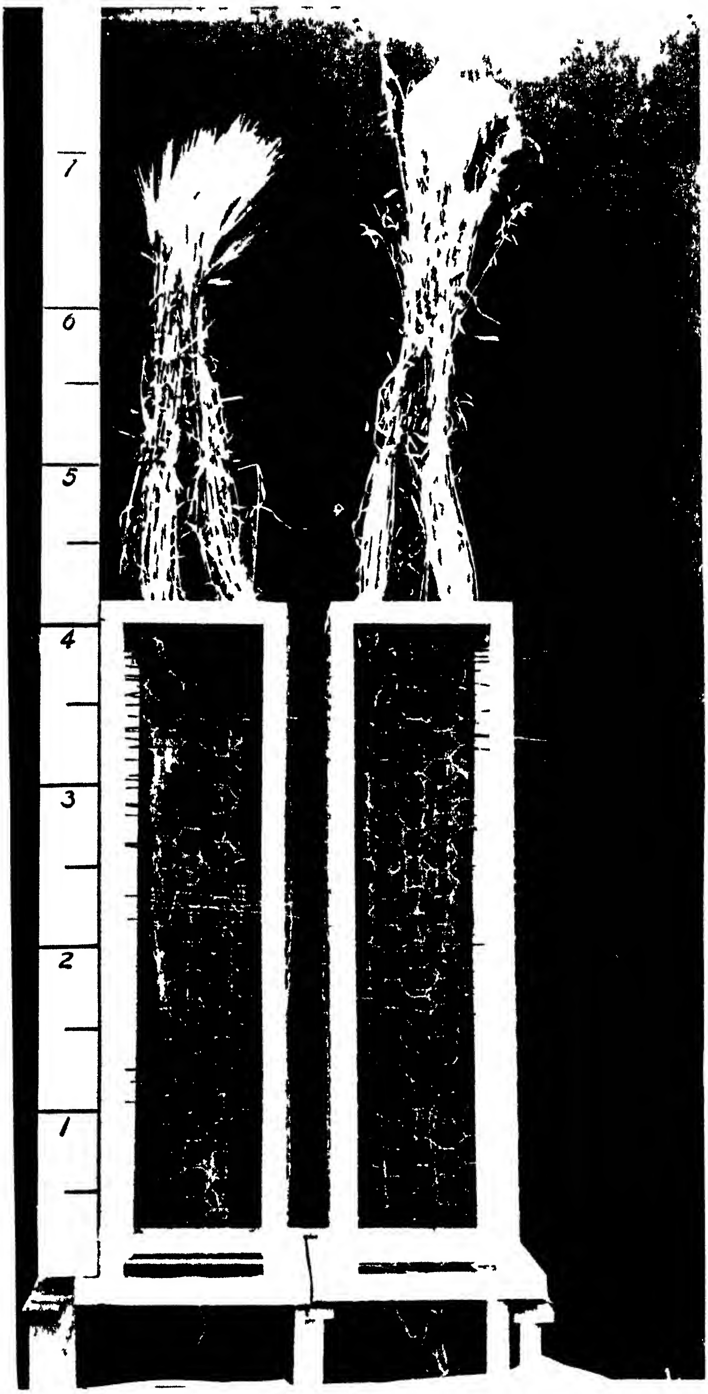


Plate CCXII

The Root System of Barley and Oats at Maturity

(Kansas Agricultural Experiment Station)

Breeding Drouth-Resistant Crops.

Up to the present time very little has been done in the way of breeding drouth-resistant crops. The native grasses of the West thrive there by Nature's breeding and selection, and not by the hand of man. Nearly all of the other crops, and even the varieties of each, which are grown successfully in the West to-day have been introduced from other lands which have a climate similar to that of the Western Plains. These crops are either native to the country from which they come or they are varieties of crops which have been developed in the older civilisations of the world, where man, by persistently growing a crop and planting seed year after year for decades and even centuries has at last, through natural selection, produced varieties better adapted to resist the adverse conditions than the original variety from which the strain sprung Such are the durum wheats, the Kherson oats and emmer. By this natural selection, certain varieties of crops grown in the West to-day are becoming gradually better adapted to the climate and soil conditions in which they must grow.

There is no doubt also that farmers may hasten this natural selection by which plants and crops become more hardy and productive In my judgment, this result can be soonest and most surely accomplished by a system of "broad" selection in which the seed of a large number of the most desirable plants of like type is selected and planted, continuing the selection from year to year until the type and characters desired are fixed and uniformly reproduced in the crop. An advantage also of this "broad" system of selection is that it can be readily and successfully practised by the farmer upon his own farm, thus adapting varieties to local conditions and environment This method is readily applicable to the breeding of grain and annual crops, but for the breeding of perennial grasses and alfalfa it cannot be so successfully practised Such crops may best be bred by the specialist and at the experiment stations

Drouth-resistant crops must be bred in the regions where they are intended to grow They cannot be bred at experiment stations located in humid climates. This is one reason why so little has been done along this line We have had experiment stations in the Mountain States located in arid and semi-arid regions, but, until recently, these stations have only experimented with crops under irrigation In the last few years, Kansas, Nebraska, and North Dakota have each established sub stations in the western and drier portions of these States, and we may hope for great results from the work in crop-breeding which it is possible to undertake at these sub-stations. The experiment stations have a great work to perform.

They must co-operate with the United States Department of Agriculture and continue the work already begun of testing and introducing new crops and new drouth-resistant varieties from other lands. They must develop the native plants of the country so that they may be successfully domesticated and cultivated.

By careful breeding and selection varieties of crops now being grown may be improved, purified and made more hardy and productive and better adapted for growing under the adverse conditions in which they are placed.

The work of plant breeding is interesting and enticing; it is an important work and the problem of making more profitable and more agreeable the agriculture of the great West and of bringing into productive use more of the unproductive lands of that region is a mighty problem, and it will not be solved simply by breeding drouth-resistant crops. Along with this must be studied soil culture and the problems of soil moisture conservation. Crops can never be bred to grow without the necessary supply of water, and no matter how much the present varieties may be improved or how drouth-resistant they may become, successful agriculture in the West will always depend more upon *thorough tillage* and proper cultivation of the soil than upon the variety of the crop grown. Many other problems must be solved regarding the use of crops, market for our produce, transportation, etc., before the great semi-arid West will be made to yield a reasonably sure reward for the well-directed labour of our intelligent, progressive farmers.

NOTE.- *From the above article it will be seen that the drought-resistant crops of the United States coincide more or less with those which withstand drought best in the Transvaal.*

Kaffir Corn.—*This crop is, of course, well known and recognised for its power of surviving periods of extreme drought, and to this fact it no doubt owes a good deal of its popularity among the natives.*

Lucerne. *It should be of much interest to Transvaal farmers to see the theory of dry-land lucerne vindicated in this manner. We may feel quite sure that if it is worth while to grow lucerne on the dry arid lands of the Western States of America it is certainly worth our while to cultivate this crop in the Transvaal where our conditions are so much more favourable.*

Mealies. *Are as a rule fairly capable of living through dry spells, but the crop as a whole cannot be looked upon as one of the best drought-resisters.*

Millets.—*Probably the well-known Boer manna is the best suited variety of millet for the Transvaal on account of its partial drought-proof character. When in the young stages it appears to suffer from dry spells, but once it commences to pipe, drought affects it very slightly.*

In connection with this it may here be mentioned that the new variety of millet, Japanese broomcorn, which was experimented with last year, appeared to be rather more drought-resistant than Boer manna.

Turning to the grasses we certainly appear to have the advantage. While in the Western States Bromus inermis *is considered their best grass for dry land, we in the Transvaal have tall fescue* (Festuca elatior), *reed fescue* (Festuca elatior arundinacea) *and rescue grass* (Bromus willdenowii), *all of which are practically unharmed by drought or frost once they are properly established and have got their roots well down.*

Besides these, paspalum grass (Paspalum dilatatum) *and New South Wales blue grass* (Andropogon sericeus) *appear to be quite indifferent to long spells of drought once the plants are about six months old and have got a good grip of the soil.*

Burnet (Sanguisorba minor) *is, so far as we can see, quite resistant to drought and heat, added to which it has the advantage of withstanding almost any amount of frost and remaining green throughout it all.*

Sheep's parsley (Petroselinum sativum) *has the same characteristics, but in a rather less degree.*

Hairy vetch (Vicia villosa) *is an excellent vetch, and when planted in late autumn appears to be capable of growing all through the dry winter months.*

It seems probable that there are many other plants useful for agricultural purposes, which, by proper selection, may be greatly improved so far as their drought-resistant capabilities are concerned. [H. GODFREY MUNDY, Assistant for Plant and Seed Experiments.]

AGRICULTURE IN AMERICA.

By William Macdonald, M.S.Agr., F.R.S.E.

No. II.

IN this paper we propose to deal in the first place with the rise and progress of the dairy industry in America, and, secondly, to speak at some greater length of what has been accomplished in a typical State.

It is notorious that no branch of agriculture in America has made more splendid progress, during the century which has just closed, than that of dairy farming. For in none has the art of invention, the application of modern science, and the skilled practice of the trained expert been seen to better or more signal advantage. Naturally enough, the dairy followed hard on the lines of land settlement and territorial expansion. But, in the days of the pioneers it used to be thought that the successful pursuit of this industry must be confined to certain narrow geographical areas; and visionless men were wont to take pleasure in setting out with scale and compass strange patchwork areas in that vast tract of country which lies between the Atlantic Ocean and the slow-moving Missouri. These they termed the Dairy Belt. But such zones of industry have long since been widely extended by the pressing needs of an advancing population. And since then it has been clearly shown that good butter and most excellent cheese can be made in every State in the Union. Undeniably, certain sections of the country are more highly favoured in the matter of a genial climate and a kindly soil, pure water and sweet grass; but after all the absence of advantages is often merely a stronger incentive to more serious effort. Thus it is that this industry is already firmly established in climates that we in the Southern Hemisphere would call austere, and in localities of a poor and barren aspect.

During the early part of this era the keeping of cows was a part of the general work of the farm. The care of the milk as well as the making of butter and of cheese was in the hands of the women of the household, whose methods were crude and whose utensils were coarse. Nor need we wonder that their products were often most inferior—the butter being rancid and the cheese sharp. Moreover, at this time, the markets were unorganized and most uncertain. The milch cows belonged to a mixed race of "native cattle" with here and there a good dairy animal—more the result of a casual sport than of skilled and intelligent breeding. The cows calved in the Spring and were allowed to go dry in the autumn or early winter. Winter dairying was practically unknown; and, as a rule, the cattle were both poorly fed and badly housed. In the Year Book of the United States Department of Agriculture for 1899, Mr. Henry E. Alvord states that it was a common thing for cows to die of starvation and exposure, and it was considered no disgrace for owners

to have their cattle "on the lift"* in the spring. Even in the best dairying districts the methods of the dairy were both rough and ready; the curds being worked in home-made tubs and pressed in log-presses. Everything was done by guess work; there was no order, no system, no science. Spontaneously with the growth of the larger town the business of dairying increased, yet it is interesting to learn that before the year 1850 no city had received any part of its milk supply by the railroad, and all existing demands were met by the farmers with their own vehicles.

The credit of establishing the first cheese factory belongs to Mr. Jesse Williams, of Oneida County, in the State of New York. Mr. Williams was not only a substantial farmer but also a cheese-maker of much repute. His cheese sold rapidly and at a high price, and so in order to cope with a growing trade he conceived the idea of increasing his own supply of milk by adding that received from the herd of his son who lived on a farm close by. He next approached his neighbours. This scheme of bringing together day-by-day the milk from several neighbouring farms to be made into cheese by one skilled operator proved most successful, and it was the germ from which has evolved the cheese factory system of the United States. And from that day till now, for a period of fifty-six years, the "Empire State" has held the first place in the Union for the value of her dairy products which now amount to over $55,000,000 (£11,000,000) annually. To make butter in bulk from the milk collected from adjoining farms was the next step in advance, Such establishments are properly called "butter factories" as in New Zealand; but the name "Creamery" has now been widely adopted and is not likely to be changed. The first creamery was started in Orange County, New York, in the year 1861, with the milk of 375 cows. All this constituted a notable landmark in the progress of dairying, for the effect of the establishment of these factories was, in a word, to transfer the making of butter and cheese from the farm to the factory. These primitive factories were co-operative concerns, and it was in this form that the system extended into the newer prairie regions, whether for the production of butter or cheese. That is to say, the farmers themselves co-operated in organising, building, and equipping the factory and shared in the disposal of the products; they were the joint-owners, and all who contributed milk or cream were called patrons. The business operations were managed by a Committee or Board of Directors chosen by and from the patrons. If the factory were large enough to warrant the expense, the supervision of the whole concern and all its interests was usually entrusted to a general manager selected by the Board in addition to the butter or cheese maker.

To again quote Mr. Alvord, "The first establishments received milk from patrons daily and sometimes twice a day. From near-by farms the milk was often warm from the cow at time of delivery. The milk was then kept in large vats (for cheese making) or in immense shallow pans in a cooling and creaming room until skimmed. Abundant room and expensive receptacles were necessary at the creamery. Then, for butter making, deep setting of the milk in cool water was adopted. The creameries were provided with pools or stationary vats below the floor level. Through these, cool

* An expression indicating the need of human aid to raise emaciated animals to their feet.

Fig. 1.—Butter Making, the Old Way

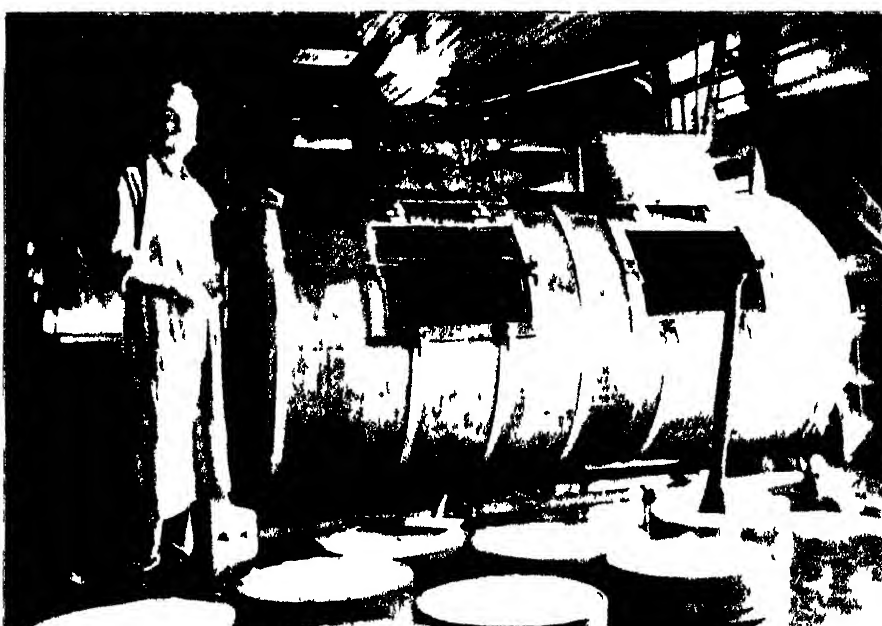


Fig. 2.—Butter Making, the New Way

Plate CCXVII

Dairying in America

(Reprinted from the Yearbook of the U. S. Dept. of Agriculture 18[illegible])

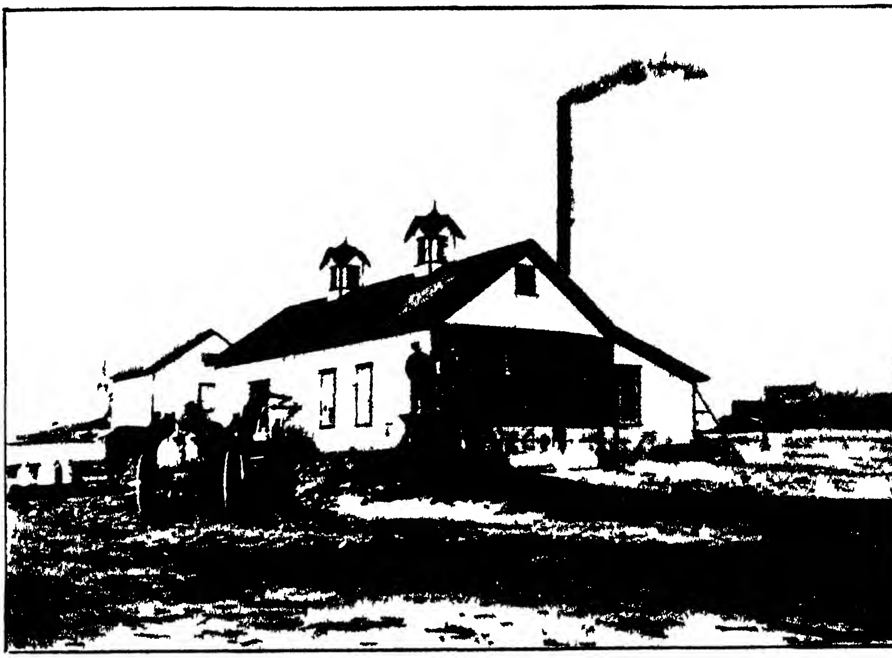


FIG. 1 A PIONEER CREAMERY IN THE STATE OF SOUTH DAKOTA

FIG. 2 A MODERN CREAMERY IN THE STATE OF NEW YORK

Plate CCXVIII

Two American Creameries.

(From the Year Book, U S Dept of Agriculture, 1899)

water flowed from springs near at hand, and in them the milk was set in shotgun cans immediately after arrival, for cooling and for the cream to form. The pools were 18 or 20 inches deep, with racks at the bottom to hold the cans. The tin cans were 22 inches deep and 8 inches in diameter, and filled so that when in the pool the top of the milk was just below the surface of the water. Springs with abundant flow and having a natural temperature of 48° to 56° Fahr. were regarded as highly desirable. Afterwards came the method of mechanical cream separation (to be later described) in place of 'setting,' or the gravity system. Another radical change, which began about 1875, was to set and skim the milk on the farms and haul only cream to the factories. Agents from the creameries, with suitable teams and carrying cans, drove from farm to farm and gathered the cream. Hence the name of 'gathered cream factories' for establishments of this class. This kind of factory is still the favourite in some good butter districts, and it has very decided merits. The earliest factories and creameries paid for milk by the quart or gallon and at the same price, all lots of equal bulk being regarded of equal value. The first step in advance on this line was to buy or credit milk by weight, but still all at the same price. On the gathered cream plan, equal bulk measures of cream were long regarded as of like value, and this is still practised to some extent. The most modern and approved plan is to pay for the milk or cream received by factory or creamery according to the pounds of fat it actually contains as experimentally determined. This will be referred to later. At first it was considered sufficient to have 200 cows tributary to a factory, and patrons were expected to be located within a mile or two, and four or five miles was the maximum haul. Larger factories were soon favoured as being more economical, and very large ones have been lately put in operation, each receiving the daily product of thousands of cows. Milk and cream are hauled twice as far as formerly to patronize a factory, and often by co-operation among the farmers along a 'route.' All patrons are now expected to cool their milk thoroughly before it leaves the farm. In the latest form of creamery management, cream is collected over many square miles of territory and transported long distances by rail to be made into butter at a central factory.

The third quarter of the century was also a period of unprecedented progress in the application of mechanics to the dairy. The factories and creameries required new equipment, adapted to manufacture upon an enlarged scale, and equal attention was paid to the improvement of appliances for farm dairies. Shallow pans were changed in shape and greatly enlarged; some were made to hold 20 or 30 gallons, and had both the bottom and the sides double for cooling or warming by means of a water jacket. Then these big pans, and most others, disappeared in favour of deep setting. This system, in which deep cans were used, set in cold water, preferably iced water, was introduced from Sweden, although the same principles had been in practice for generations in the spring houses of the south. Numerous creaming appliances, or creamers, were invented, based upon this system. Butter workers of various models, most of them employing the lever, or a crank and roller, took the place of the bowl and ladle and the use of the bare hand. Churns appeared of all shapes, sizes,

and kinds, the general plan being to abolish dashers and substitute the agitation of cream for violent beating. About this time the writer made a search of the United States Patent Office Records, which revealed the fact that forty or fifty new or improved churns were claimed annually, and, after about one-fourth were rejected, the patents actually issued, *provided a new churn every ten or twelve days for more than seventy years!* This illustrates the activity of invention in the dairy line. It was admitted by all that at this period the United States was far in advance of any other country in the variety and excellence of its mechanical aids to dairying.*

The second half of the century was a period of remarkable activity, during which fresh interest was awakened in the minds of dairy farmers by means of agricultural exhibitions or as they were more commonly called "cattle shows." But this epoch will ever be memorable because of two celebrated discoveries. We refer to the invention of the Cream Separator and the introduction of the Babcock Milk Test.

The first of these effected the removal or separation of the cream from the milk by means of centrifugal force. This device is based upon the fact that the specific gravity of milk serum or skim milk is greater than that of cream. Various types of machines are now on the market but the essential parts of a separator are the bowl, an inflow for the new milk, an outlet for the skimmed milk, an outlet for the cream, and proper mechanical means for revolving the bowl. In the process of separation the milk flows into the bowl, and those parts of the milk which have the greatest specific gravity are thrown to the extreme outside, while the lighter portions—the fat globules—are forced to the centre. The separator enables the creaming or "skimming" to be done immediately after milking, preferably while the milk is still warm. The cream can be churned at once, while sweet, but the better practice is to cool it thoroughly and then to slowly cure or ripen it for churning. This mechanical method is much more efficient than the old gravity system, securing a more perfect separation, as well as effectually preventing the loss of fat in the skim milk. Further, it greatly reduces the labour of the household. Separators are made of all sizes and various patterns, and can be worked by hand or by simple or complex power—such as by a dog, a sheep, an ox, or a horse, water, electricity, or steam. This is the usual method where the separation is done on the farm itself. But in the creamery system the milk is usually first aired and cooled on the farm and hauled once a day to the factory. Here it is passed through the separator, and the skim milk carted back to the farm and fed to young animals.

In many districts, to save time and labour, "skimming stations" have been established at convenient points, and equipped with one or more powerful separators. The milk is brought to these centres for separation from the several farms in the immediate vicinity, and from thence the cream is carried to the central factory for curing and churning. These separators are capable of creaming from 15 to 500 gallons of milk per hour. A machine of standard factory size has a speed of from 6,000 to 7,000 revolutions a minute and a capacity for creaming 250 gallons of milk an hour. The dairy world is indebted to Sweden for this beautiful

* Year Book of the U.S. Department of Agriculture, pp 387 and 389.

machine. The first centrifugal separators were put into practical use in Great Britain and America in the year 1879. And the century closed with more than 40,000 of these machines in operation in the United States alone. The invention and perfection of the Separator* has been the main factor in building up the modern dairy industry. For the marvellous efficiency of this machine has not alone reduced the former heavy losses, but by the great saving of labour has also made butter making possible in many localities where before it was unknown.

The second notable achievment in the agricultural annals of this period is the introduction of the Babcock milk test—so-called from the name of the discoverer, Dr. S. W. Babcock, the eminent chemist and dairy bacteriologist attached to the Wisconsin Experiment Station. This test which was first made known to the world in the year 1890 is a quick and easy substitute for the more laborious method of chemical analysis. It is simple, accurate and easy to manipulate. To destroy the solids in the milk, other than the fat, Dr. Babcock makes use of a single re-agent, commercial sulphuric acid, and to separate the fat from the remaining contents of the test bottle centrifugal force is used. Besides the machine and its fittings the only supplies needed are sulphuric acid of standard strength and warm water. In the economics of the dairy industry this butter fat test has had an important bearing. And there is much truth in that pithy saying, common amongst the Colonists of the Commonwealth, that the Babcock test has been more efficacious in keeping the good name of Australian dairymen above reproach than all the eloquent teachings of the Church. For the percentage of fat as a measure of the true value of milk has been universally accepted as the basis of municipal milk inspection, in cheese factories and creameries, and in all payments to the patrons of co-operative dairy associations. Moreover, by this simple test the dairy farmer may find out, without much loss of time, the quality of the milk of every cow in his herd and so accurately determine their real value as dairy animals. In fact, nowadays, cows are usually bought and sold on the basis of their milk yield and the Babcock test. Such, in brief, is the story of an invention which has proved of inestimable worth to the scientist and a priceless boon to the working dairyman. And it is a pleasure to recall that this contrivance was made in the chemical laboratory of an Agricultural Experiment Station. In an age and in a land conspicuous for men of large fortunes there is surely something noble in the action of one who might well have been many times a millionaire, yet freely gave his splendid gift to his own people, and to the world at large, without money and without price. This public service has been gratefully acknowledged by the members of his own Legislative Assembly of Wisconsin; and we of the British Empire may well take pride in the generous and spontaneous action of the dairymen of New Zealand who presented Professor Babcock with a handsome testimonial.

* There are various separators on the market to-day, each of which is claimed by its manufacturer to have some special merit. The following are well known:—Alpha De Laval, Melotte, Sharples Tubular, United States, Empire, Vega, etc. The following firms will be glad to supply prices to any farmer or agricultural association:—Messrs. Clarke Bros. & Brown, Ltd., P.O. Box 2,215, Johannesburg; J. & E. Hall, Ltd., Johannesburg; and Isaac Haarhoff, Pretoria.—[AUTHOR.]

It is instructive to note that the shorthorn breed, imported from England, led to a gradual and marked improvement of the native cattle. Shorthorn grades formed the foundation of most of the dairy breeds, and much of this blood is still found in prosperous dairy centres ; but shorthorns have been so widely bred for beef qualities that a need was soon felt for more exclusively dairy cattle. Thus it came about that Ayrshires, Holstein-Friesian, Jersey and Guernseys, were introduced at a later date. Nor must we omit to mention the Brown Swiss and Simmerthal cattle from Switzerland, the Normandy breed from France, and the Red Polled cattle from the East of England, all of which have also been used to a greater or lesser degree.

Speaking of the introduction of dairy cattle and efforts at herd improvement, Mr. Alvord writes :—

"The progress made in this respect in fifty years has been remarkable. When improvement upon the native stock began, a cow that would make a pound of butter a day for two or three months was a local celebrity. Now and then a single animal made a really noteworthy record, like that of the Oakes cow, famous in Massachusetts about 1836 (Plate CCXIX). This cow gave 44 pounds of milk a day and made 467 pounds of butter in one season, but she was evidently a sport and failed to reproduce her equal. The first good record of definite herd improvement was made by Zadock Pratt, of Greene County, New York. By careful selection and culling he increased the average butter product of his 50 cows from 130 pounds for the year 1852 to 225 pounds in 1863 ; for seven years the average milk yield was 4,710 pounds per cow. About 1865, when good cows sold for $40 (£8) or less, an enterprising dairyman in New England advertised widely that he would pay $100 (£20) for any cow which would yield 50 pounds of milk a day on his farm for two or three consecutive days. Not an animal was offered under these conditions. The good dairy cow has now been so long bred to a special purpose that instead of the former short milking period, almost limited to the pasture season, it yields a comparatively even flow of milk during ten or eleven months in every twelve, and if desired the herd produces as much in winter as in summer. A cow that does not average 6 or 7 quarts of milk per day for three hundred days, being 4,000 to 4,500 pounds a year, is not considered profitable. There are many herds having an average yearly product of 5,000 pounds per cow, and single animals are numerous which give ten or twelve times their own weight in milk during a year. Quality has also been so improved that the milk of many a cow will make as much butter in a week as did that of three or four average cows of the mid-century. While some herds average 300 to 350 pounds of butter a year, occasionally more, and authenticated records of cows giving two pounds a day are very numerous, rivals to the Oakes cow may now be found frequently, often several in one bovine family, the dairy merit maintained and transmitted by judicious breeding ; and although animals of such excellence are none too common, they no longer excite astonishment or incredulity."

Hence, the dawn of the twentieth century finds the dairy industry of America profoundly different from the crude domestic art of three or

Year Book, U.S. Department of Agriculture, p. 392.

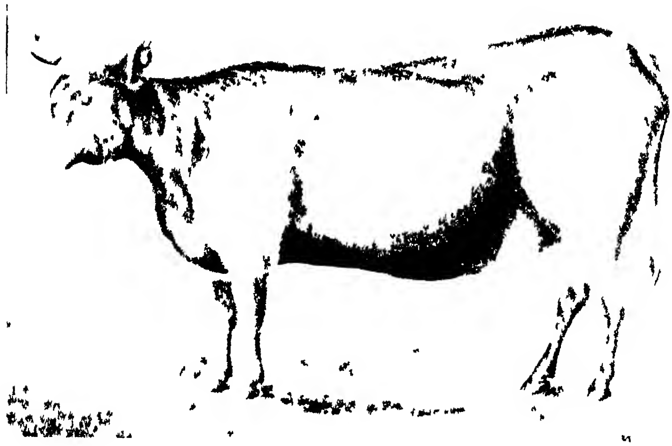


FIG. 1.—THE OAKES COW.

FIG. 2.—DAIRY BULL, MODERN TYPE, GUERNSEY.

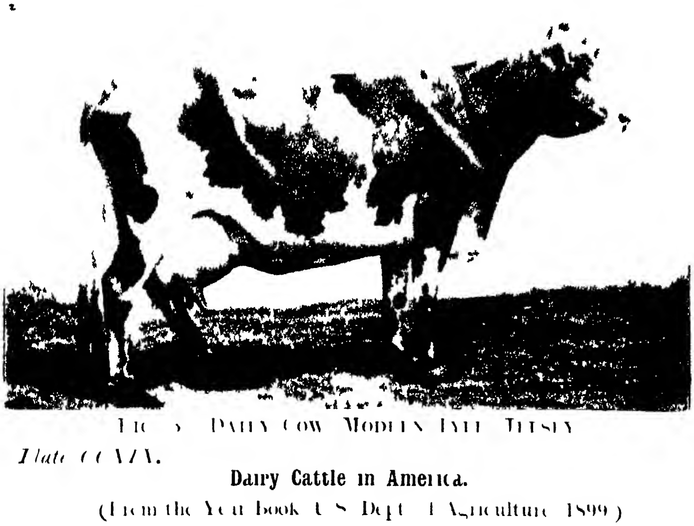


FIG. 3.—DAIRY COW, MODERN TYPE, JERSEY.

Plate CCXX.

Dairy Cattle in America.

(From the Year book U. S. Dept. of Agriculture, 1899.)

four generations ago. For the factory system of co-operative manufacture has taken the place of home dairying to such an extent that in many counties it is almost as hard to discover a farm churn as to unearth a spinning wheel. But in one respect the labour of dairying is much the same as a hundred years since. Cows have still to be milked by hand. Although numerous attempts have been made, and patent after patent has been issued, no mechanical contrivance has yet been invented to surpass the human hand in milking. Wherefore, twice a day, every day in the year, dairy cows must be milked by manual labour. Reckon it up "allowing 10 cows per hour to each milker, which means lively work, and you will require the continuous service of an army of 300,000 men, working ten or twelve hours a day throughout the whole year, to milk the cows kept in the United States." For us in the Transvaal, dependent upon the careless and wasteful methods of the natives, a mechanical milker would verily prove of the greatest service.

Again, within recent years there has been a great advance in the economical use of the by-products of dairying. Ten years ago enormous quantities of skim milk from creameries, and of whey from cheese factories, were absolutely wasted. Now these valuable secondary products are not only used in feeding calves and pigs but, in many places, more especially around the larger factories, new industries have come into vogue which make sugar of milk from the whey and, at the same time, utilize the skim milk in a dozen diverse ways.

Let us now turn to the rise and growth of the dairy industry in a noted agricultural State. If you leave New York at 3.30 p.m. any day in the week, on the "Twentieth Century, Limited," you will reach Chicago next morning at 8.30 having gone close on a thousand miles in the short space of 18 hours. You will hardly care to linger long in Chicago for it is a gloomy city, and the same evening you may leave on the "Pioneer, Limited," and reach the picturesque city of Minneapolis at 8.30 next morning, having travelled 1,500 miles from the great Metropolis.

Minnesota stands at the head of the Mississippi Valley, where are to be found the remote sources of the Mississippi, or the "Father of Waters": the famous Red River of the North, and the mighty St. Lawrence, whose various waters flowing in different directions reach respectively the Gulf of Mexico, Hudson Bay, and the Atlantic Ocean. Visited by the French explorers in 1660, the historian further records that a portion of this State formed part of the Province of Louisiana, purchased by the United States from France in 1803. In 1858 it was admitted as a State of the Union. To-day, it has a population of over 2,000,000, with an area of 83,000 square miles, and is therefore nearly three-quarters the size of the Transvaal. Such in brief is the history of the North Star State—Minnesota—or as it is quaintly called in the Indian tongue, the "Land of the Sky-Tinted Water," long renowned in romantic literature. For just outside the city are the lovely falls of Minnehaha—'Laughing Water"—immortalized by the poet Longfellow in "The Song of Hiawatha." Look at the map and you will notice that the State lies half-way across the Continent and impinges on the Province of Manitoba, which belongs to our Sister Nation the Dominion of Canada.

Minnesota is mainly an agricultural State of which the wheat industry is the most famous. Last year the yield of wheat was 2,434,234 bushels. Formerly the farmers raised only grain. It was then wheat, wheat, wheat, nothing but wheat. In the adjoining State, and indeed throughout the whole North-west, a similar state of affairs prevailed.

A western dairy expert sums up the situation in his own homely style.

"The North Dakota farmers have made money too easily. A pretty broad statement, but nevertheless a true one. When 25 to 30 bushels of wheat could be grown on every acre, and a ready sale found for it, from seventy-five cents to one dollar per bushel with three or four weeks' hard work during seeding time, and again during the harvesting and threshing season, money is made too easily for our own benefit. The time has come when we must adopt a different system of farming. Even with last year's large crop some counties averaged but ten bushels per acre, and selling for only forty-five cents per bushel.* Still our farmers are loath to give up wheat growing and turn their attention to 'dairy farming—farming that has made some of the richest States in the Union.

"Advocate more dairying and you are met with the statement that dairying don't pay. Of course it don't pay. Neither will any business conducted in the manner dairying has been in this State. The cost of raising an acre of wheat can be told to the fraction of a cent. How is it with dairying? 'Yes! I milk a few cows during the summer, but if I have more butter than I can use, have to sell it at the stores for from 8 to 10 cents (4d. to 5d.) a pound, and then my cows go dry as soon as cold weather comes on, when butter is high, and don't even give enough milk to supply the house.' Nature intended your cow to give enough milk to supply her calf, and then go dry, and in letting her rustle for her own living you are allowing her to follow that course. All good milch cows are artificial. They have been made. Make your cow. Study her as you would a machine, have her drop a calf in the Fall (Autumn), then feed her and house her properly, and you will make dairying pay."†

In the early days there were but few cows in Minnesota: milk and butter were mostly used by the family or exchanged at the local store for groceries and other necessaries. The average farmer was wholly occupied in raising grain for the market, and he had no idea of converting grain and forage into such valuable products as butter and cheese. But the time soon came when the southern part of the State was invaded by grasshoppers and chinch bugs. A few crop failures resulted in deferred payments, mortgaged farms, and a heavy fall in the value of real estate. A cloud of general depression followed; the settlers were forced to turn to other branches of agriculture, and for a number of years the cow became the chief support of the ruined farmer; while at the same time greater care was paid to the rearing and feeding of calves. That a gradual change was taking place in the farming industry was made plain by the census returns for the year 1890, which showed that there were over half a million milch cows in the State.

* A bushel = 60 lbs. (approx.).

† Bulletin No. 22, North Dakota, p. 3.

As a rule the gathered-cream-plan where old methods of setting milk were used, did not give satisfactory returns: but wherever separator creameries were established on the co-operative plan—in localities having a sufficient number of cows within a radius of a few miles—the venture proved profitable. A few of the so-called gathered-cream plants were started in the southern half of the State. A man with a team drove from farm to farm collecting the cream and taking it to the churning plant. But the cream was of a most inferior quality, being made in the kitchen, pantry, woodshed, or cellar, and partaking of the combined odours of vegetables, drain pipes, and cow-barns. Under such conditions the butter was of a poor quality, being chiefly noted for its strength and the variety of its flavours. Again, the price for which it sold was low, at least, judged by our present standard. It is worthy of note that the principle of co-operative dairying and the use of a cream separator was first urged by Mr. Hans P. Jensen, of Bath, Freeborn County, who had visited Denmark, and while there investigated the co-operative creamery system For several years he pleaded for the establishment of one in his own neighbourhood, and in January, 1890, a meeting was held in the town of Bath to consider the advisability of establishing such a plant. On May 5th of the same year, the farmers began bringing in their milk, the machinery of the creamery was put in motion, and Mr. Jensen had the satisfaction of seeing the first creamery started in his own village of Bath—the germ of this great industry. There are now over a thousand creameries in this State alone.

In the year 1891 a dairy school in connection with the State University was founded where young men could fit themselves as fully qualified butter and cheese makers. The benefit of this movement has been amply demonstrated by the marvellous growth the dairy industry has made since that time. In the spring of 1892 Professor Haecker made a tour of the State and visited the various factories, meeting the leading dairymen and breeders of dairy stock, in order to study the most urgent needs of the industry. The northern part of the State was first inspected, and later the western and south-western portions. Over almost the whole of this country the cream gathering system was in vogue. The churning plants were mostly established in some old shack of a building, insanitary and poorly equipped, handling stale and sour cream, turning out rancid butter, and paying such low prices that the farmers were universally dissatisfied.

By August, of the same year, Freeborn County was reached and there a few new co-operative separator creameries, owned and managed by the farmers, were found in operation. These creameries were in good condition, and equipped with the best machinery; the buttermakers were skilled in their work, and well paid, and the patrons seemed greatly pleased with the results obtained. There in Freeborn County it was decided what was the first and most important thing to do, to promote dairying throughout the State; namely, to completely re-organize the prevailing dairying methods by doing away with the cream-gathering plants which were nearly all owned by companies or individuals, and to substitute

farmers' co-operative separator creameries. A little later Professor Haecker issued a bulletin urging the organization of such creameries; giving the number of cows necessary within a given radius to warrant the establishment of a plant, and discussing the proper methods of organization; the importance of restricting members to one vote; how to raise the needed funds for the building and equipment, and provide a sinking fund for liquidating the indebtedness; as well as drawing up articles of agreement and bye-laws for the Government of the various associations, etc. This bulletin placed the dairy division in close touch with the farmers, and during the next few years much of the time of the dairy experts was devoted to creamery and cheese factory propaganda.

And the apostles of the new agriculture preached the gospel of the dairy cow along the highways and by-ways; by the street corners of the crowded centres, and over the counter of the lonely prairie store where two or three were wont to gather together. In this promising work the railway companies co-operated and in many cases took the initial step, while the Farmers' Institutes held special enquiry meetings to meet the call for information on dairy matters. The growth of the industry was phenomenal, and taxed the dairy school to the utmost to provide young men qualified to take charge of the new plants which were being established. By a system of co-operative effort on the part of the Dairy Division of the University, the Farmers' Institutes, the Dairy Associations, the Butter and Cheesemakers' Associations, a vigorous educational campaign was carried on during the following four years. Monthly contests in butter scoring were inaugurated, and each year a large number of special local dairy meetings were held. This period was one of extraordinary activity and an earnest effort was made to secure larger yields of milk, whilst, at the same time, improving the quality of the dairy products.

Thus at the close of the year 1895, the Year Book of the Department of Agriculture gave the number of milch cows in the State as 618,530, being an increase during the past five years of 52,500 or practically 10,000 per year. For the next decade no effort was spared to spread the gospel of dairying and the members of the State Butter and Cheesemakers' Association, who were nearly all graduates of the University Dairy School, became a prominent factor in this missionary enterprise. By their skill in the art of manufacturing dairy products, and by their enterprise and enthusiasm in the good work they did much towards raising the quality of Minnesota's dairy products.

Of this period Professor T. L. Haecker, of the Dairy Division of the University of Minnesota—to whom we would gratefully acknowledge our indebtedness for much of the information contained in this article—writes as follows:—

"It is a source of great satisfaction and some pardonable pride to know that no State in the Union has made as rapid progress during the fifteen years under review as has Minnesota. There are many States that have more and better cows, more experienced dairymen, and as favourable soil and climatic conditions; but in no State has there been such an earnest

and persistent effort to build up the industry upon a solid and equitable foundation; to protect the milk producer from scheming promoters and to keep out poor machinery and unqualified operators.'

The following tables clearly show the growth of the industry.

Table No. I.

NUMBER OF COWS, MILK, AND BUTTER FAT.

Year.	Cows	Lbs Milk per cow	Lbs Butter Fat per cow.
1890	566 000	2 800	110
1905	900 000	3 500	133

Table No. II

PRICE OF DAIRY PRODUCTS AND GROSS RETURN.

Year	Price of Butter Fat	Earnings per cow	Gross return
1890	12 c per lb (6d)	$13 00	$7 500 000
1905	22 c per lb (11d)	$29 00	$26 100,000

So from being the first wheat growing State in the Republic, Minnesota has become one of the foremost in the realm of dairying. At the Paris Exhibition in the year 1899, Minnesota won the only grand prize on a tube of butter made at the New Sweden Creamery, and as Professor Haecker truly says: 'A craft that brought to the State and to the Nation such splendid honours and such material reward certainly merited the loyal and liberal support of the people.' The above statistics show that there are to-day in the State 900,000 cows which produce an annual yield in dairy products of over £5,000,000 sterling. It is thus that Minnesota has gained for herself the proud title of the "Bread and Butter State."

Now, how has this been done? It may be averred that this State was naturally fitted for farming from the very first Not so! Minnesota began as a very poor county: she has seen hundreds of settlers massacred by the Indians; she has lost thousands of cattle in blizzards; drought and disease have taken their annual toll; while prairie and forest fires have ravaged every district. Her first settlers were a poor people. Many worked for pitifully small wages and lived in "dug-outs" made by digging a cave in the side of a bluff in order to pay for their first 40 acres of land. But these men had unyielding courage; and the North-west can boast of more than one brave man who began life in a "dug-out" and died a Senator in the City of Washington.

Method of Organisation.

In Minnesota it has been found that in starting a creamery in any locality, the first thing to do is to ascertain if the required number of cows can be secured within a radius of four or five miles, which is about as far as milk can profitably be carried. This is called the "*Pledge of Cows.*" If less than four hundred cows are secured, the project for the time being is dropped. Creameries established on the co-operative plan with a sufficient number of cows have almost always given satisfactory results.

Moreover, the success of the Minnesota farmers has been mainly due to their method of organisation. They do their own organising and have nothing to do with creamery agents who go about the country soliciting stock, getting out articles of incorporation, building the creamery, and turning it over to the farmers. It sounds all very nice; but it has been proved after bitter experience that no one can organise a creamery as cheaply and as effectively as the farmers themselves. And in almost every case where these ready-built and fully equipped creameries have been turned over to the farmers, they soon discovered that they had paid from £100 to £400 more for the plant than it was worth.

The old plan of providing funds for building creameries was for each subscriber to take one or more shares in stock, paying cash for them. In most parts of the State it was found hard to raise money under this plan as many good farmers were quite unable to raise the amount of cash required to build and equip a creamery. To overcome this difficulty each patron of the proposed creamery is now simply asked to sign his name to an "*Organisation Agreement*" and to give the number of cows he will provide. At the close of this paper we append* for the use of our Transvaal farmers the articles of agreement and bye-laws which were first drawn up by the Freeborn County Creameries in the State of Minnesota, and which have been found most satisfactory.

This agreement provides for borrowing the amount of money required to build the creamery; and each farmer signing the agreement agrees to be responsible for the payment of the sum borrowed. There is no district in the whole State where someone cannot be found who would be willing to lend $2,000 (£400) more or less to an Association of 25 to 50 or more farmers, each one of whom agrees to be personally responsible for his share of the loan. When the required number of subscribers and cows have been secured a meeting of patrons is called, and the articles of agreement and bye-laws drawn up and adapted to local circumstances. You will notice that Article 2 of the bye-laws provides that 5 cents (2½d.) on each 100 lbs. of milk received at the creamery shall be retained to form a "*Sinking Fund*" to be used to pay off the money borrowed. This five cents per hundred pounds deducted from the amount of milk taken to the creamery is not felt by the patrons. Moreover, even after this amount has been deducted they will get more out of their milk than by making it into butter themselves. So that the creamery is gradually paying for itself without expense to the patrons. Let us take a simple sum. A creamery receives 10,000 lbs. of milk a day, that is to say, at the rate of 20 lbs. of milk per

* Appendix A.

day from 500 cows. If 5 cents per 100 lbs. of this amount went into the Sinking Fund, it would be five dollars a day equal to $1,825 per annum, so that in a little over one year the loan of $2,000 could be paid off and the creamery would be clear. Naturally, a special arrangement would need to be made for new suppliers who could not expect quite the same terms as the first or foundation members.

Article four of the agreement authorises the Board of Directors to borrow the sum required, and the loan is paid back out of the Sinking Fund as fast as it is accumulated. This plan enables the creamery to be started without the farmers having to *find ready money*, and at the same time it gives the creamery Association the cash necessary to buy lumber, materials and machinery at the lowest prices.

Even in Minnesota there are some creameries and cheese factories which are idle at the present moment, and it is well to ask why this is so. After a thorough canvass of the State it was found that about half the vacant creameries were in localities where there were *too few cows*; others failed because they were owned by people who would not pay enough for the cream to make it worth while for the farmers to patronize them.

It is much better to have no creamery at all than an idle one, as it is much more difficult to resurrect a dead creamery than to build a new one. The harm done to the dairy industry by an idle creamery is simply incalculable. Bear in mind that a creamery is not a producer of milk, but merely a means of handling it. A district doing badly is a most unprofitable investment and a great hindrance to dairy development. We recall one dead creamery built by professional organisers. Brought into existence by a big celebration, a railroad excursion, a banquet and a general warming up, everything except the old cow. In sizing up the situation a farmer friend sagely remarked "Most any jingle-jawed creamery agitator can build creameries on farmers' autographs, but it takes cows to run 'em." Yes! 400 cows first—then a creamery—not run by a professional creamery agitator, but by an organisation of interested farmers.

Occasionally, the separator is the cause of failure. Imperfect skimming on each 100 lbs. of milk may result in an annual loss of several hundred dollars.

Thus Mr. Kaufman, of the North Dakota Experiment Station, writes:

"The advantages of a creamery over the private dairy are quite marked. A creamery receiving the product of 300 cows should receive 6,000 pounds of milk per day. With the best system of gravity creaming, that of the submerged can, as in the Cooley system, one-tenth of the butter fat is lost in the skim milk. 100 lbs of milk should make 5 lbs. of butter. Then 6,000 lbs. of milk would produce 300 lbs. of butter, but one-tenth is lost in the skim milk, making a loss of 30 pounds at twenty cents (10d.) per pound, or six dollars (£1 4s. approximately) per day. Enough to pay for the creamery in a year. Some farmers using the shallow pan system, or shotgun can without properly cooling the milk lose as high as one-fourth of the entire product. On the majority of the farms the principles of buttermaking are not sufficiently understood to permit of producing a first-class article, or the make is not large enough to call for a sufficient

outlay of time, and consequently the milk is neglected. As a result we have an over production of 'store butter' that even won't make good axle grease. At the creamery the milk of the neighbourhood is collected, and handled by an experienced man, who has made a special study of buttermaking. With the improved dairy machinery, the fat is removed to a trace, the cream ripened and churned, the butter coloured, salted and worked uniformly, and 500 or 1,000 pounds of butter of uniform quality and grain put on the market instead of a like amount of a dozen different colours, salted in various ways, not worked sufficiently or worked to death. The difference in price between '*store butter*' and '*creamery butter*' is of itself sufficient argument to convince one of the advantages of the creamery system. The less work required to care for the milk where the creamery is patronised must not be lost sight of Granting there is no loss of fat, and that the price is the same whether made in the creamery or private dairy, it will pay you to patronize the creamery, for the saving of work alone, especially if you are not well equipped for making and handling your own product."*

The hardest part of the whole scheme is usally the location of the creamery. The best site for all the farmers must be selected. Four things are to be considered :—

(1) *A central spot.*—(In some Minnesota creameries any farmer over 4½ miles from the place finally selected has the privilege of withdrawing).
(2) *On a railroad.*
(3) *Pure water supply.*
(4) *Good drainage*

Proximity to a cess-pool has more than once ruined a creamery in destroying the flavour of the butter. No buttermaker can make a first-class article under such circumstances.

Furthermore, without a competent buttermaker, the best equipped plant, loyally supported by the farmers, can only result in failure. The best creameries employ the best men. The qualifications for a good buttermaker are, honesty, tact, and business ability. Some creameries in Minnesota pay as much as $100 (£20) per month, which is a high wage in America. But the winners of the State and International prizes are not found in the farmers' own expressive language amongst the "kid-gloved fancy sort," who simply oversee the "help" and take a "dress parade" half-holiday every afternoon. A high grade of butter can only be made from good wholesome milk. The patrons of a creamery may be likened to soldiers with the buttermaker as their captain, and his orders should be faithfully obeyed. He must insist that the milk is delivered clean and free from leaves, dust, sticks, and more offensive substances.

Again, the value of a good cow is very manifest from a study of the creamery record books of some of the most profitable creameries in the States. The average butter production per cow in many of these western creameries for the past few years has not exceeded 150 pounds. A farmer with ten cows making 150 pounds each year gets 1,500 pounds of butter.

* Bulletin No. 22.

A man with five cows averaging 300 pounds each per year gets the same amount of butter and has only half the number of cows to feed, milk and care for This shows the remarkable saving in cost of production which may be effected by keeping only the best grades of dairy cows. In many districts in New South Wales unless a cow produces at least 200 lbs. of butter per annum after the third year it is disposed of as unprofitable.

In factories where milk is purchased, a price is agreed upon for milk of a certain standard, say one dollar for a hundred pounds of milk containing four per cent. fat, the price paid being greater or less than this as the per cent. of fat is greater or less than 4 per cent.

The following example will serve to illustrate :—

Name of Patron	Lbs of Milk.	Per cent of Fat.	Lbs. of Fat
A	3,500	3·40	119
B	1,200	4·00	48

The total fat in each patron's milk is found by multiplying every 100 lbs. of milk delivered by the per cent. of fat. thus :—

The fat in A's milk = 3,500 x ·034 = 119.
„ „ B's „ = 1,200 x ·040 = 48

At one dollar per hundred pounds for 4 per cent milk, this would have been twenty-five cents per pound for fat, and these patrons would have received :

Patron		Amount received by each
A	119 x 25	$29·75
B	48 x 25	$12·00

Mr. Earnest Mathews in his admirable little volume speaks thus :

"The real test of the value of milk is its richness in butter fat. Analyses show that there are very wide differences between the milks of the various breeds of cattle mentioned above, which, if reduced to their money value, would show as much as 50 per cent. in favour of some over the others. An example will make this clear. At one of the trials at the Dairy Show two cows competed whose milk, when analysed, gave the following figures :—

	Weight of Milk.	Fat percentage
First Cow ...	$2\frac{3}{4}$ gallons ...	2·43
Second Cow ...	$1\frac{3}{4}$ „ ...	6·83

Assuming the value of milk containing the regulation 3 per cent. of fat to be worth 6d. per gallon—that is, estimating the unit of fat to be worth 2d.—the value of the milk of the first cow would be worth about 5d. per gallon, while that of the second would be worth about 1s. 1¼d. per gallon ; consequently the value of the milk of the first cow would be only 1s. 1¾d., while the value of the second would be 2s., or a difference in favour of the cow yielding the smaller quantity of milk of 10¼d. This example is of course given only as an extreme one, and to show the importance of ascertaining the value of milk containing a large percentage of fat ; but as it is usual where milk is sold to creameries to make the percentage of butter fat the basis on which the value of the milk is calculated, perhaps

this 'extreme' instance will serve the purpose for which it was introduced. The percentage of fat in milk can be easily ascertained by either the Babcock or Gerber methods."*

Further on Mr. Mathews says :—" If there is occasionally some slight loss in selling milk of too good quality at the price of the ordinary standard, there is a still greater loss in using poor milk for making butter, although this is very frequently done. The butter ratios of the various breeds of cattle tested in the show grounds during the past ten years prove that under the most favourable circumstances it only pays to make butter from the richest milks.

To make this plain, the quantity of milk of each breed that is required to make one pound of butter is here given, the ratios having been altered from pounds of milk to gallons, the liquid measure appealing more to the eye These figures are taken from the London Dairy Show report of 1901

3	gallons of	Red Polled milk	made 1 lb.	of butter.
$2\frac{17}{20}$	,,	Shorthorn	,,	,,
$2\frac{13}{20}$	,,	Ayrshire	,,	,,
$2\frac{3}{20}$	,,	Guernsey	,,	,,
$1\frac{18}{20}$	,,	Jersey	,,	,,

Estimating the value of the milk throughout at 8d. per gallon, the cost of one pound of butter will be as follows :—

Red Polled butter	.. .. ..	1s. 9d. per lb.
Shorthorn ,,	.. .. ..	1s. 8d. ,,
Ayrshire ,,	.. . ..	1s. $6\frac{1}{2}$d. ,,
Guernsey ,,	.. .. ..	1s. 3d. ,,
Jersey ,,	.. .	1s. $1\frac{1}{4}$d. ,,

These figures, however, do not really represent all the loss that is made by using poor quality milk for making butter, since they only show the prime cost of the milk used, which, until the selling price of the butter made is ascertained, the profit or loss cannot accurately be gauged."†

The striking success of co-operative creameries in Minnesota has already been noted, and, in passing from this subject, we may merely add that this State received the highest awards at the St. Louis and Chicago Exhibitions. She won all the gold medals in the City of Omaha, and scored the highest average of any State at the National Buttermakers' Convention, while the exports of butter alone, independent of home consumption, bring in an annual income of more than £3,000,000. This splendid result has been due to the industry of the people under the guiding hand of the State. The Government has made no direct contributions, but she has assisted in many ways by means of the experts connected with the Dairy Division of the State University and the Instructors attached to the Farmers' Institutes. This combination of science and industry has resulted in the wonderful extension of dairying in the North-west Butter is now made in the finest creameries equipped with the most perfect machinery, stored in cold storage rooms, and transported in refrigerator

* "Economies in Dairy Farming," p. 3. † Ibid, p. 51.

cars and steamships to the markets of the world. Thus the whole line of march is lit up with the light of modern science from the time the milk leaves the wagon of the farmer at the door of the creamery till the butter is placed upon the table of the consumer in London or Amsterdam.

Summing up the conclusions of the experience of Minnesota we would say :—

That you should start with 400—500 cows within a radius of from four to five miles.* With less than a pledge of 400 the idea had better be postponed, because a creamery without patronage is an expensive luxury. Do your own organising; place your creamery in a central position with good drainage and plenty of pure water; equip it with the best and latest machinery; spend some time in visiting neighbouring creameries; take counsel with the Agricultural Department regarding articles of incorporation and bye-laws; then definitely decide upon the best plan to suit your own case; and finally that you earnestly strive to make a good start, for the prosperity of a large neighbourhood will surely follow, because a creamery organised by painstaking farmers is a pride to the district and a lasting evidence of agricultural prosperity.

And now it rests with us to ask if something similar cannot be done for the Transvaal. Let us put the initial cost of a small creamery at £2,000. How is this sum to be raised ? The reply to this question is that it is generally understood that the recommendations of the Land Bank Commission would make possible the raising of such a loan under certain conditions, but the proposals we now put forward must be taken in a purely tentative manner, because the whole of this question is still under the consideration of the Government. Briefly, the necessary sum of £2,000 might be guaranteed by, say, some twenty to forty substantial farmers, and the Land Bank would lend the whole amount required under a limited or unlimited liability scheme, the loan to be paid back within a certain stated period. If, to form a sinking fund, the equivalent of 1s. per day of milk be deducted from, say, forty farmers, it would mean £2 per day, or over £730 in the year, and so in less than three years the creamery would be clear without any money cost to the farmer. Possibly, the most practical method would be to deduct from the monthly cheque of each farmer 5 or 10 per cent., the amount of this sum to be credited to each supplier at the close of the year.

In the interval of waiting until the Government establishes a Land Bank, it might be advisable for our farmers to form a *committee* to visit some of the Natal, Cape Colony, and Orange River Colony creameries; to obtain a pledge of cows; to draw up articles of incorporation; to enquire into the cost of equipment and prices of machinery; to locate a satisfactory and central site; and to consult with the Department of Agriculture. Then whenever the Land Bank comes into being they will be ready to start work at once, and so be the pioneers of an industry which in our humble opinion is destined to transform the whole agricultural industry of this Colony.

* For the Transvaal this figure would have to be materially increased.—[AUTHOR.]

Recently, we were asked by one of our readers what would be the cost of a plant to deal with the cream of about 1,000 cows of the usual Transvaal quality In reply we would state that the cost of a butter-making plant including refrigeration to deal with the cream of this number of cows would be approximately £900 completely erected, providing transport were furnished from the nearest railway station in the Transvaal. This, of course, does not include the building. It would, however, be advisable to obtain quotations for each individual case. A creamery can be built of ordinary stone or bricks, the floors should be cemented, the walls plastered inside and outside, and preferably tiled inside in the dairy room proper. Windows and proper ventilation must be provided.

In order that the proposed co-operative factories should promote harmony and not discord amongst the patrons, a word of caution may not be out of place. In Australia it has been found that creameries which turn out the finest butter are invariably those that receive and separate the milk at the central factory, or at the various local skimming stations. And the reason is not far to seek, since this plan enables one uniform first-class grade of butter to be produced—or a more or less ideal product Now, where the farmers separate the milk themselves, there is always liable to be trouble, more especially if the cream is not sent in daily. For example, one farmer may wish to hold back his cream for two or three days in order to collect a fair quantity; consequently, the cream reaches the factory in various stages of ripeness, and to produce a uniform sample of butter is practically impossible. Further, some cream may be sour; whilst another batch may be half churned through careless transport, and so forth. Thus, at the outset, such details should be considered carefully before the creamery is finally established.

Here are two simple sums which will enable us to calculate the produce of a certain number of cows :—

I.—Let us take 1,000 ordinary grade Shorthorns, Frieslands, or Ayrshires at an average of two gallons* (20 pounds) of milk per day=20,000 lbs. of milk per day. Now 25 lbs. of milk = 1 lb. of butter on the average. Therefore 20,000 lbs. ÷ 25 = 800 lbs. of butter per day; which at 1s. 3d. per lb. =£50 per day.

II.—To produce 1,000 lbs. of butter per day. Again 1 lb. of butter = 25 lbs. of milk (approximately) = 25,000 lbs. of milk per day. Each cow gives two gallons. Therefore 1,250 cows are required.

The most practical utensil for bringing in the cream is a large well-tinned cream can having a float that can be moved up and down to suit varying quantities of milk or cream, and so keep out the dust and prevent the cream from churning during transport. Another question of importance is how long will butter keep without refrigeration ? This is very difficult to answer, as everything depends upon the conditions under which the butter is made and the season of the year. Properly made and carefully kept butter should keep about ten days in summer and three weeks in

* 6 bottles = 1 gallon.

winter. This is where there is no refrigeration. Stored in cold chambers and transported in refrigeration cars butter will keep good for many months. Based on experience in Natal, it will stand transport up to seventy miles. Butter should be transported quickly on a light spring wagon, preferably by night.

A further point that will have to be considered is: "where could an expert butter-maker be obtained, and what would be his salary?" It is probable that competent young men could be got from Natal or Cape Colony or the Orange River Colony at a salary ranging from £300 upwards. We are informed that fully qualified dairymen could easily be procured from Sweden or Denmark at a salary of, say, £20 per month and travelling expenses under contract. These dairymen and butter-makers would possess certificates from Government or recognised private dairy schools.

Yet another question. "Would there be any difficulty in disposing the butter at a remunerative price?" First-class Colonial butter finds a ready sale in Johannesburg, and there should be no difficulty in getting good firms to take up the agency under contract of all the butter any proposed dairy will turn out. We may mention that the Bedford and Adelaide Creameries, in Cape Colony, are now consigning to Johannesburg daily; and the average price that the butter fetches is from 1s. 4d. to 1s. 6d. per pound. At the same time we are of the opinion that the Government should take this matter up and see that special facilities are given dairy farmers for marketing their produce. It is as important for the Government to help the farmers to get a good market for their produce as to spend money simply in building creameries. For a time will surely come when all the local markets will be fully supplied, and our farmers will need to turn their attention to the English and Continental markets, and this means rapid and cheap transportation, Government inspection of all butter intended for export, and a host of minor details which can only be achieved by the Government acting in sympathetic co-operation with the rural community. To illustrate this point consider the small country of Sweden, where not only are there dairy experts in each Province, who see that all butter intended for export is up to the Government standard, but besides these there is also an Agricultural Adviser or Commercial Attaché in London whose sole function is to find a market for Swedish butter in England, and to advise his Government respecting the needs and the demands of the British market.

With figures we have begun, with figures we will close. Let us take 5,000 dairy farmers, as a conservative estimate, for the whole of this Colony. Give to each farmer 30 cows. Reckon to each cow 150 lbs. of butter per annum, and you will have produced each year in the Transvaal alone from these 150,000 cows 22,500,000 lbs. of butter. Sell this at 1s. per lb. (a low figure), and you will realise the grand total of £1,125,000 per year. And for us in the richest mineral state in all the world there is an old saying by the wisest of men, which is surely of strange significance and worthy of being writ in letters of gold:—"*Be thou diligent to know the state of thy flocks, and look well to thy herds, for riches are not for ever.*"

APPENDIX A.*

The following agreement of organisation, articles of association and bye-laws are used by the Freeborn County Creameries in the State of Minnesota:—

ORGANISATION AGREEMENT.

We, the undersigned citizens of.............County, State of Minnesota, do hereby agree to form ourselves into an Association, to be known by the name of the ....Association, and we agree to borrow the sum of...........dollars, or less, to put up a building and equip it with the necessary machinery, and jointly, to become personally responsible for the sum borrowed, including interest. The money to be raised in the manner agreed upon by the Association. We also agree to furnish the milk from the number of cows opposite our names.

NAME. COWS.

ARTICLES OF AGREEMENT OF THE...............ASSOCIATION.

We, whose names are hereunto subscribed, and whose residences are within the County of.............. in the State of Minnesota, do hereby associate ourselves together as a co-operative association under the laws of the State of Minnesota, and have adopted the following constitution, viz.:—

ARTICLE I.

The name of the Association shall be the...............Association, and its place of business shall be at or near Section............ in the town of........... in said ....County.

ARTICLE II.

The object of this Association shall be the manufacture of butter or cheese, or both from whole milk, at actual cost.

ARTICLE III.

The officers of this Association shall be a President, Vice-President, Secretary, Treasurer, and three Trustees, who shall be elected annually at the regular annual meeting and the Association to be held on the first Monday of January of each year, and their term of office shall be one year and until their successor shall have been duly elected and qualified.

ARTICLE IV.

The duties of the respective officers shall be as follows:—The President shall preside at all meetings of the Association, sign all drafts and pay over to the Treasurer all moneye which shall have come into his possession by virtue of his official position, taking the Treasurer's receipts therefor. He shall have power to call special meetings of th Association whenever in his judgment the business of the Association shall require it.

The Vice-President shall perform the duties of the President when he is absent, or otherwise unable to attend to them.

The Secretary shall keep a record of all the meetings of the Association, and make and sign all orders upon the Treasurer.

The Treasurer shall receive and receipt for all moneys belonging to the Association, and pay out the same only upon orders which shall be signed by the Secretary; he shall give bonds in such amount as the Association shall provide.

The President, Vice President, Secretary and Treasurer and three Trustees shall constitute a Board of Directors, whose duties shall be to audit and allow all just claims against the Association. They shall compute the amount of milk receipts, the amount of product sold and the moneys received therefor, and after deducting from the total receipts the percentage herein provided for as a sinking fund, and also the running expenses, on the 20th day of each month divide the remaining receipts of the preceding month among the members and patrons of the Association, proportionally to the amount of whole milk or fat furnished by each. Provided, however, that in the case of the withdrawal of any member from this Association before the moneys herein provided to be borrowed shall have been paid in full, principal and interest, all product from milk furnished by such withdrawing members then on hand, and any moneys received from such product then in the possession of the Association shall be retained until all such moneys so borrowed shall have been fully repaid and thereafter said moneys, or any remainder thereof, after applying the just share of such withdrawing members therefrom to the repayment of balance of such indebtedness not paid from the sinking fund, shall be paid over to him or his assigns.

The Board of Directors shall cause the Secretary to make, in writing, a report to the annual meeting of the Association, setting forth in detail the gross amount of milk receipts, the net amount of receipts from product sold and all other receipts, the amount

* Bulletin No. 35, Minnesota Agricultural Experiment Station.

paid out for running expenses, the sums, if any, paid out for milk, and all other matters pertaining to the business of the Association. A like statement, containing the gross amount of milk receipts, the net receipts from product sold and all running expenses of the creamery shall be made and posted conspicuously in the creamery building at the time of the division of the prior month's receipts as aforesaid.

The Board of Directors shall borrow a sum of money not exceeding.............. thousand dollars, to be used by them in the erection, completion and furnishing of the creamery building and for no other purpose. Said members of said board may borrow said money on their individual responsibility, and in case they shall do so, then the sinking fund herein provided for shall by them be applied in payment of such borrowed moneys as the same fall due in the same manner as though said moneys had been borrowed by the Association. Said members of the board in such case shall be held to be the creditors of the Association to the amount of such moneys unpaid, and the several members of said Association shall be personally responsible, jointly and severally, for the same. Provided, however, that prior to any legal assertion of such individual responsibility, the entire sinking fund then accrued and on hand shall be applied upon such indebtedness. And provided further, that said members so borrowing said moneys may, if they so elect, demand and receive any part or all of the moneys received from product sold, then in the possession of the Association, upon such indebtedness before enforcing such personal responsibility. In which case only that part of such indebtedness remaining after applying thereon all sums so received shall be recovered or demanded from the members of the Association.

ARTICLE V.

The several members shall furnish all the milk from all the cows subscribed by each, all milk to be sound, fresh, unadulterated, pure and unskimmed, and patrons of the Association not members may, by agreement with the Board of Trustees, furnish such amounts of milk as may be agreed upon. The Association shall receive all such milk so furnished, manufacture the same into butter, cheese or both, and sell and receive all moneys from the product, and from the moneys so received deduct such a percentage thereof, or such a number of cents per one hundred pounds of milk as shall have been agreed upon by the Association in the bye-laws or otherwise, and also deduct the running expenses of the creamery, the remainder thereof to be distributed as provided in Article IV. hereof.

ARTICLE VI.

Each member shall be entitled to one vote only at any meeting of the Association. New members may be admitted as provided in the bye-laws. Members shall be permitted to withdraw only as provided in the bye-laws.

ARTICLE VII.

The first officers and Board of Trustees shall be as follows: .... President; ....Vice-President: .... Secretary; ....Treasurer: ....Trustees.

ARTICLE VIII.

The constitution may be amended at any annual meeting, or at any special meeting called for that purpose, provided that two-thirds of all members present vote in favour of such change; and provided further, that at least one month's notice of such proposed amendment shall have been given in such manner as may be provided in the bye-laws, or otherwise by the Association.

NAMES.

BYE-LAWS OF THE..............ASSOCIATION.

I.

The Treasurer shall give bonds in the sum of................dollars, the bond to be approved by the Board of Directors.

II.

Five cents on each one hundred pounds of milk received at the creamery shall be reserved to form a sinking fund.

III.

No milk shall be received or business of any kind transacted at the creamery on Sundays.

IV.

During the interval between the twentieth day of May and the twentieth day of September of each season all milk shall be delivered at the creamery as early at least as nine o'clock a.m.; during the remaining portion of the season as early as ten o'clock a.m.

V.

All milk delivered shall be sweet and in good condition; if any be found otherwise, the operator may condemn the same, and in such case he shall notify the President thereof. The operator shall test the milk of each member and patron at least three times a week.

VI.

Any member or patron of the Association found skimming, watering, or in any manner adulterating his milk offered at the creamery, shall forfeit to the Association as follows:—For the first offence, ten dollars; for the second offence, twenty-five dollars; for the third offense he or she shall forfeit all interest in the Association and also all claims for milk theretofore delivered to the Association. But no such forfeiture shall be adjudged without first affording to the member or patron charged with having so skimmed, watered or adulterated his milk, full opportunity to defend himself from such charge. Any member sending to the creamery any bloody or unhealthy milk, or any milk from any cow within four days after calving, shall if convicted of having done so knowingly, forfeit as prescribed above in this section.

VII.

Members and patrons furnishing whole milk may take from the separator or the tank at the creamery, four-fifths of the quantity of milk (in pounds or quantity) delivered at the creamery by them on that day. Any member taking therefrom more than such amount shall forfeit to the Association the sum of five dollars for each such taking.

VIII.

Withdrawals from the Association shall be allowed only as follows:—The member desiring to withdraw shall give at least one month's notice of his application therefor. Such application shall only be allowed on a vote of two-thirds of all members present and voting at any meeting for hearing at which such application shall have been noticed. Provided, however: That any member living more than three miles by the nearest road from the creamery building, may make application to the Board of Directors, who in their discretion may grant permission to such member to withdraw from the Association.

IX.

Any member refusing to deliver at the creamery the milk agreed to be there delivered, shall, without reasons satisfactory therefor to the Association, forfeit all interest in the product on hand.

X.

Notice of any proposed amendment to the Constitution shall be in writing or printing, and shall be kept posted prominently in the creamery building, and also on the walls of the delivery department for the reception of milk.

THE MAGGOT FLY.

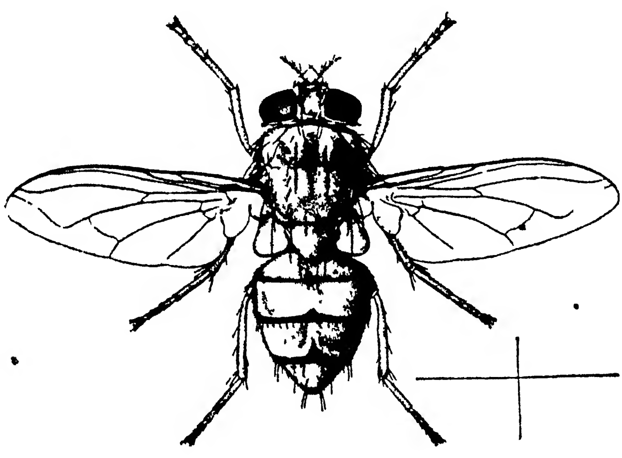
(*Bengalia depressa*, Walker.)

By Dr. F. Arnold,

District Medical Officer of Health, Northern Transvaal.

RECENTLY, at a meeting of the Pretoria Medical Society, a physician read some notes of cases of maggots found in the skin of human beings; he believed that they had their origin in the eggs of a fly. Periodically, doctors in South Africa see such cases. In 1891 a Pretoria medical man described the disease, and, at odd times since, others have done the same.

Persons affected with these maggots exhibit on their bodies spots which look like very-full boils; at the point of the boil is a small dark crust, and, on pulling this off, there is seen a small aperture from which exudes a little cloudy fluid. Complaint



The Maggot Fly.

(*Bengalia depressa*. Walk.)
Natal to the Bahr-El-Ghazal.

Yellowish brown; margins of abdominal segments, dark brown; legs, same colour as body; wings, brownish.

(From the Second Report, Wellcome Research Laboratories, Khartoum.)

is made of pain and great itching in and around the spots. On grasping the "boil" at its base between the finger and thumb, and firmly squeezing it, there slides out a maggot of any size up to half-an-inch long and about one-tenth inch wide at its thickest part.

The maggot fly has, for a long time, been known in Natal, the Transvaal, Rhodesia, Uganda, and British Central Africa; it has also recently been found in the Sudan. The following account of it is abstracted from the Second Report of the Wellcome Research Laboratories, Khartoum, to which any reader desiring further details is referred.

The Fly.

The fly is half-an-inch long with wing expanse of about an inch. The head is large, brown in colour, and yellowish-brown between the dark prominent eyes. The chest is rusty to yellowish-brown, with dark lateral and dorsal bristles. The abdomen above is pale brown, shows two dusky bands, and is darker at the apex; below it is pale. The legs are of a tint similar to the pale colour of the thorax. The transparent wings are tinged, especially at their bases, with dusky brown. The fleshy mouth-parts are not adapted to pierce the skin, on the other hand, the female has a sharp needle-like ovipositor. The ova are elongated and white, and about 3/50ths of an inch in length.

The Maggots.

The larvæ, or maggots, are creamy-white in colour, with deep-brown spines. When mature, they are half-an-inch in length. On the head are two blunt processes, each of which bears a small blunt nipple-like process. The body is, by sharply-marked constrictions, divided into nine segments; on the back of the front part of the first two segments are short brown thorn-like spines; the third, fourth, fifth and sixth segments have many similar spines all over them; the seventh has very much smaller, paler and scanty spines; the eighth and ninth have none. The segments are deeply constricted and the spines are particularly prominent on the lateral borders. Ventrally the larvæ are spiny just as they are dorsally. The puparium is stout, oval, dark purple in colour, and, as a rule, covered with a mealy down.

The fly deposits its eggs in the hair or clothing, the latter being apparently often selected when hanging out to dry, so much so that, in certain parts of Africa, it is said to be dangerous to wear woollen clothing next to the skin. They are also said to lay their eggs on bedding. The sharp ovipositor seems to point to their being able to lay their eggs directly in the skin. The larvæ rapidly bury themselves under the skin where they at first produce a boil or swelling which becomes inflamed and painful owing to the accumulation of excreta and the rasping movements of the spiny maggot. Maggots may be found in any part of the body, but it is thought that the scalp is most often affected. The wounds left in the skin after the maggots have been squeezed out heal rapidly if treated with antiseptics, but the scars may remain for some time. Infection may take place either at night or during the daytime.

The adult fly is very sluggish in nature and does not move about on windy days; it is difficult to drive away, but easy to kill.

Pupation takes place in the ground.

Besides man, *Bengalia depressa* attacks dogs, rabbits and other animals.

THE VETERINARY SECTION.

HORSE BREEDING IN SOUTH AFRICA FROM AN INDUSTRIAL POINT OF VIEW.

By J. M. Christy, A.P.V.S.

The first point to be considered under this heading is, can horse breeding be carried on as a profitable industry in South Africa? To arrive at a reasonably accurate conclusion it is desirable that we should know something of the past history of the horse in this sub-continent, and of the economic conditions of the present day affecting his production and influencing not only the horse markets of South Africa in particular, but those of the civilised world in general. Further, we should know the type or types of horses best adapted to the climate and soil of South Africa, and, bearing these in mind, decide the best kind of horse we can place on the markets available to us. To do this successfully we must know exactly what markets we can send our horses to and the stamp of animal we are likely to have to compete with in them.

History of the South African Horse.

This is comparatively modern, as, prior to the occupation of the country by the white man, the horse was unknown there. It is interesting to note that early accounts state that some native tribes rode oxen, guiding them by lines passed through a hole bored in the cartilage of the nose, but all agree that there were no horses in South Africa when the first white men landed there. We might, therefore, expect to be able to give precise and definite information on this point. Unfortunately, it is exactly the opposite, as there are practically no reliable records to be consulted, and, on a matter such as we are inquiring into, tradition and hearsay evidence are most unsatisfactory, indeed, frequently misleading. The saying "Darkest Africa" occurs to one here. I would therefore suggest to any of my readers who possess information on the point to publish it in the "Agricultural Journal" for the benefit of readers.

The first horses brought to South Africa are said to have been a mixture of the Barb and Gulf Arab introduced by the Dutch East India Company in the early days of the settlement; but it is stated that their progeny greatly deteriorated as the result of in and in-breeding, and no care in the selection of breeding animals. To remedy this the Company imported Persian Arabs. This was about 1688, and, in 1782, eight stud horses were imported from England, the breed not being stated, though it is reasonable to assume that they were of the early English roadster or half-bred stamp of horse, as we understand them to-day, at that time coming into prominence in Great Britain. The same year, five stud horses arrived from Boston, U.S.A.,

and, the following year, a number of horses and mares were brought from the New England States in America. These are said to have been of Spanish or Eastern blood. An anonymous writer to the "Cape Monthly Magazine" says, "Previous to the year 1800 the only breed of horses then found at the Cape were of Eastern importation, chiefly Gulf and Arabs, but, in March, 1807, during the Napoleonic Wars, two French vessels were captured here containing some Spanish breeding horses *en route* to Buenos Ayres for breeding purposes. It is from these that we derive the blue and red roans so invaluable for their great powers of endurance." Shortly, this is the origin of the South African horse at the date of the permanent occupation of the Cape by the English, and his characteristics were those of a strong, hardy animal, wanting in symmetry, perhaps, small, but possessed of great powers of endurance and ability to maintain himself on the ordinary vegetation of the country, qualities which he has maintained to the present day. The mounted commando appears early in the history of the white man in South Africa and has remained with us down to the present day. The first commandoes are depicted as mounted on wretched, scraggy representatives of the horse tribe, but those of recent times were on small hardy horses with a lot of quality, of great endurance, capable of traversing long distances with a minimum of food and water. How was this change brought about? We are told that it was not until 1813 that any attention was given to the improvement of the South African horse, and that this was attempted by means of the importation of the thoroughbred English horse. During the three decades following the year 1813, first-class English thoroughbreds continued to be imported, the gentlemen who were chiefly responsible for this being Lord Charles Somerset, Governor of the Cape Colony, and Messrs. van der Bijl, Cloete, van Breda, Melck, Kotze, T. B. Bayly, Charles Barry and others.

About this time a considerable export trade in horses was done with India, and many good remounts for the Indian Army came from South Africa. Why this trade lapsed is not very apparent, though Australia has benefited largely by it, but it was certainly not on account of the unsuitability of the South African horse for Indian Army work. Note the opinion of one old Indian officer writing of these horses: "For a good all-round horse capable of standing hot and cold weather in the open and keeping his condition through it, recommend me to the stamp of horse that was imported from the Cape during the Mutiny," and, again quoting from the "Cape Monthly Magazine," Captain Gall in his report, January 31st, 1865, says: "Out of the forty-four Cape horses purchased by the late Colonel Havelock in 1837 . . no fewer than thirty-seven were actually present in the ranks after having done eleven years' service, although exposed to all weather throughout the year." Were further proof wanted, Colonel Apperby, writing in 1859, supplies it. He remarks: "I have a very high opinion of the Cape horse, particularly with reference to their fitness for the ranks of the Indian Army. The only complaint is their want of size, caused principally by their starving the mares and foals."

As the white man penetrated inland from the sea he carried the horse with him, and a valuable riding and driving horse was bred in the north of Cape Colony, the Orange Free State and Natal, and, in later years, in the high veld of the Transvaal. The greatest defect from a market point of view of the South African horse was his deficiency in size. To remedy this, Dutch stallions were imported: animals with prominent crests, large quarters and small middles, but with showy, prancing action. They were not a success, and Mr. T. B. Bayly describes them as "mis-shapen brutes which had injured some of the oldest studs in the Colony." Hackney and Cleveland stallions were imported for the same purpose with, it is stated, satisfactory results, but I am afraid that what was gained in size by these importations was lost in stamina.

The Basuto pony has sufficient individuality to be classed as a distinct type. He is largely the progeny of mares obtained by the Basutos from farmers in the north and north-east of Cape Colony and the Orange Free State. Instead of accepting money, the native boy would agree to serve his master for a given time for a certain animal, usually a young filly, and would then agree to serve a further term if his master allowed her to be got in foal by one of his stallions. In this way the Basutos gradually became the possessors of a number of good mares, small, perhaps, but hardy, accustomed to live on the veld, and of great endurance. I am told that, once a year, the chiefs collected all the young entire colts and set them to race two miles out and two miles back. Only the half-dozen or so who came in first were allowed to remain entire, all the others were castrated, and, in this way, animals of tried stamina only were kept as stallions. I admit I am sceptical about this, and would like better-informed persons to give us the benefit of their knowledge. As to feeding and general care the Basuto pony was left to attend to these matters himself, hence their hardyhood and small size. The mountainous nature of the country accounts in a measure for their activity and surefootedness.

Economic Conditions.

The economic conditions of the present day affecting the production of the horse are, with slight differences, much the same in South Africa as in most other parts of the civilised world.

At no time in the history of the world has the demand for really good horses been greater, and the prices all round better, than now, despite the fact that this is the age of electric and steam traction, and that motor cars and bicycles are everyday sights, and that flying machines, aeroplanes and balloons may soon become so; therefore, it is logical to argue that, no matter what the future may hold for us in the way of fresh inventions for locomotion, the usefulness of the horse and the demand for his services will not be materially affected. The increase in population and wealth resulting from civilisation and latter-day inventions all tend in the long run to increase the demand for the horse both for use and pleasure, and a recognition of these

facts should be a powerful source of encouragement to breeders to face the future with confidence. Were proof of this wanted, one has only to glance at the history of South Africa, Australia, America (North and South), India and Europe, to be convinced that, for every horse required in those countries one hundred years ago, there are, to-day, ten horses contributing to the material welfare and enjoyment of their inhabitants. Outside and beyond this commercial and sporting idea is the no less important question of the demand for and value of the horse from a military point of view. His increased and enhancing value here is so apparent that I do not intend to devote any space to emphasising its importance, simply pointing out that mobility is now recognised as a most important factor in all military operations, be they small or large, directed against a powerful enemy with established bases and long lines of communication to guard, supply, and look after, or against a vanishing guerilla and will-o'-the-wisp sort of enemy difficult to locate and more difficult to bring to account.

SUITABLE TYPES.

In a previous article (Selecting and Judging of Horses for Breeding and Show Purposes, see page 341 of the "Agricultural Journal" for January, 1907) I stated that there are four types of horses and practically only four that should be attempted to be bred, namely, the Draft Horse, the Carriage Horse, the Roadster, and the Saddle Horse. This is true of all countries, but it is desirable that we should decide which of these particular types, or how many of them, South Africa can successfully produce, always keeping in mind the markets available to us in which we can dispose of them.

In the past, the South African horse met the requirements of South Africa, but, in the words of a writer in the "Agricultural Journal of the Cape of Good Hope" for February 1907, "For the purposes of commerce to attract foreign buyers, the animal is useless." Why is this so? The work expected from a horse in South Africa is much the same as he is expected to do in other countries, and, in South Africa, we see that the native breed does it on scant rations, the objection to him in a foreign market being his want of size and the lack of knowledge of his inherent good qualities. That he possesses the latter qualities in no small degree is unquestioned by all who know him, but to capture and hold foreign markets we must send to them horses possessed of the known endurance of the South African type, yet with size and bone. That the South African horse has stamina and endurance excelled by horses in no other part of the world proves that the climate and soil of South Africa generally are suitable to the breeding of horses, and that, on that point, we need have no misgivings. It is, therefore, essential that if we intend to place horses on foreign markets to do all in our power to improve the size, bone and quality of the horses of the country.

I do not think much can be done here with pure draft animals, but a strong active horse suitable for draft purposes should find a

market in our larger towns and be of use also to some farmers as farm animals.

It is the riding horse, the roadster, and the carriage horse that I think would be found most suitable.

The way to produce such horses is by judiciously mating the mares of the country with sound thoroughbred English stallions possessed of size, bone, quality and action, or with South African stallions possessing the required qualifications. That something could also be done by importing young mares of the proper stamp is unquestioned, but I fear that the expense would be too great, besides they would not do well, at least at first, if allowed to run on the veld, and to keep them stabled would be out of the question and undesirable, whereas stallions could be easily stabled. A point that I would like to emphasise is the absolute necessity of castrating all colts unlikely, either from their breeding or appearance, to be suitable for stud purposes. I would even go farther and castrate all nondescript entire horses, because as long as they are about, even with the greatest care, you never know what sort of a foal your mare is going to have.

CLIMATE.

British South Africa is situated in the sub-tropical and temperate zones, and a large part of the Transvaal is from three to five thousand feet above sea level with a climate that should be suitable to the horse. Fowler says: "All existing species of the family Equidæ are developed in open, dry and generally elevated plains. None are inhabitants of gloomy forests or reeking marshes. Fresh air, dryness and light are essential to their well-being." The climate and conditions of the Transvaal appear to fulfil these requirements, yet, by sad experience, we know how the awful scourge of horse sickness bears heavily on the horse breeder, owner and dealer in the Transvaal.

Were it not for horse sickness this article would be superfluous, as, with that exception, the soil and climate of South Africa are in every way suitable to the breeding and rearing of a high-class horse capable of holding his own with his compeers in any country in the world, and, possibly, when his good qualities are known and properly appreciated, supplanting less favoured individuals in the horse markets of the world.

More able pens than mine have dealt with horse sickness in South Africa. The man who shows how to protect our horses against this terrible scourge will also solve the question of horse breeding in South Africa from an industrial point of view. Can this be done? Science would answer, unhesitatingly, yes, provided facilities are given; in other words, money to inquire into and find out all about the cause of the disease.

MARKETS.

That those of South Africa should belong to the South African breeder is beyond question, yet, at the present time, we import horses from Australia and the Argentine. Undoubtedly, the late war has

had a lot to do with this, and, as time goes on, South Africa will, or ought to, be able to supply its own demand in that respect and have a surplus for export. Where do we propose to send this surplus? Are the markets of Europe too far from us? Are we able to supply the demand for Indian Army horses? That we can do the latter is certain if we breed horses suitable in appearance for the Indian Army, but we must, by a pushing and forward policy, convince the authorities in India that our horses are altogether superior to those they can import from any other country. When the Cape to Cairo railway is an accomplished fact, and when we have lines of fast steamers plying between ports on the Western seaboard of Africa and Europe with a sea journey of less than a fortnight, there is no reason why we should not be able to compete successfully with our North and South American friends. Good animals suitable for saddle or harness work will always find a ready sale in Europe.

* * * *

SOME OBSERVATIONS OF CASES OF HORSE SICKNESS*

Which occurred in the Transvaal Field Force during the campaign against Sekukuni, in the months of October, November, and December, 1879, and subsequently on the return of part of the Force to Pretoria in the last month. These notes were taken conjointly with Mr. Moore, M.R.C.V., in charge of the Veterinary Department of expedition, who treated the cases referred to in the following pages, and the remarks as to therapeutical means are the result of his recent experience.

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As the prevalence and fatality of disease in horses, mules, etc., in south-eastern Africa are of considerable importance, and the subject had attached to it even increased interest in consequence of the exigencies of a campaign, an opportunity having been afforded during the recent operations of investigating the symptoms of the disease while the animals were ill, and the morbid appearances in fatal cases, a few remarks as to the nature of the affection, treatment and morbid signs after death may be of use. Possibly the observations now submitted may have been recorded by others. The literature on this subject available in the field being extremely limited, in the present instance, a small pamphlet, issued under the authority of Lord Chelmsford, and the annual report of the Colonial Veterinary Surgeon, being the only authorities it was possible to consult.

* A correspondent sent us the following paper taken from Jeppe's Transvaal Book Almanac for the year 1881, in order to compare the present state of our knowledge with that of twenty-six years ago. Dr. Theiler, to whom we submitted the article, writes as follows :—

"The paper should be considered more as a relic, and, of course, the interpretations of the present day are of an entirely different nature. For instance, at the time when the paper was written, typhoid fever in the human being and horse-sickness in equines were considered to be due to the same cause, whereas now we know that such is not the case. The general outline of horse-sickness is correct, and it was interpreted according to the scientific knowledge prevalent at that time; but our recent knowledge places us in the position of being able to place an entirely different construction upon these observations."—[EDITOR, "Agricultural Journal."]

The information derived from the settlers, contractors and other persons who had seen many cases of the disease, and who, in several instances, had lost considerably by the disease, was found to be meagre, and their methods of treatment not merely empirical, but, in some cases, perhaps as dangerous as the disease, and not based on any definite understanding of the nature of the ailment. To account for the liability to pulmonary diseases on plateaux high above the sea level, it is a matter of direct inference from physical causes that, when an animal is transferred from a region of comparatively low elevation to one much higher, that the balance of vitality as regards the respiratory function must be, more or less, disturbed; the amount of the oxygen is less in the volume inspired, while the expansion of the blood—a result of the decrease of atmospheric pressure—renders the oxygenation of the blood more difficult; after a time the system accommodates itself to the altered condition, and so-called acclimatisation results.

That there was considerable difficulty in breathing after slight exertion was obvious, for some time after the animals reached the high plateau above the Delberg, on the way between Middelburg and Fort Weeber, a difference of 1,600 feet existed, the animals in high condition suffering more from dyspnoea than those inferior in that respect, the laboured breathing of the former after a short canter being well marked—even a gentle trot soon caused a cough.

The great alteration of temperature between day and night, and the sudden changes which frequently occur in this respect, even during the day, are also conditions which tend to develop disease in animals unprotected by stables or clothing. Assuming the foregoing circumstances to have some validity to indicate a state of things predisposing to lung affections, the manner of off-saddling and outspanning usual in South Africa appears to furnish an exciting cause. When the halt takes place, the saddle or harness taken off, the animal, although sweating profusely, is turned loose; should it stale and then roll, further care is thought to be unnecessary, and the beast is allowed to graze until the time comes to inspan. The day's journey over, the horse is either turned out knee-haltered or tied to a waggon, a sheet being seldom put on. The night air, perhaps, causes a chill, engorgement of the lungs sets in, aggravated by the accumulation of grass and gas in stomach and intestines; the animal is found dying or dead in the morning, and the miasma of the locality or the noxious quality of the herbage get the discredit of the sudden attack.

Further, there are strong reasons to enquire, are not many of these cases of lung disease symptoms of fever of the typhoid type, communicable perhaps from man to beast and *vice versa*, the vehicle of infection, the pans and water-spruits, the sources from which for many miles of road across the high veld water is alone procurable? The pans or pools, almost stagnant, which lie generally along the base of low hills, are connected with each other by a small ooze or trickle of water not sufficient to keep the contents pure. The spruits frequently take their course over disintegrated granite, a formation

which is not considered likely to improve the water. When marching across the high veld on several occasions, dead animals were found rotting in the water-courses or festering on the bank from whence the next rain was certain to wash morbid matter into the stream, if it may be dignified by the name. It appears also that sick animals make for the water, and thus, by their evacuations before death and their decomposition afterwards, poison the supply for miles. Persons well acquainted with the country consider that the water in these courses is annually decreasing in volume.

The Headquarters left Pretoria on the 18th October, 1879, and from the statements of persons long resident it would appear that horse sickness was less prevalent than usual at this time of the year. Still, the cases seen were sufficiently numerous and typical to furnish a report as to the course of the disease and suggestions as to treatment.

The fatal cases showed as morbid appearances hyperæmia of lungs, congestive bronchitis, adema, pleurisy in nearly all, and two cases of lobular pneumonia with bronchitis. Venous system generally engorged, heart contained large clots chiefly on right side; no abnormal signs were detected in liver, spleen or kidneys, except congestion. In some cases the muscles were dark, in other cases pale; in the latter intense pulmonary hyperæmia probably is the cause. The animal's body was much swollen, the large intestines enormously distended with gas, and, in a few instances, with fluid fœces. In most of the examinations the small intestines were more or less inflamed, frequently the purple tint of the bowel showing where the inflammation was more pronounced. In these the veins and glands of mesentery were swollen and dark coloured; on internal coat of bowel, patches of congestion with adema of submucous tissue and grumous fluid of pea soup consistence on surface where the inflammation existed. In one case a similar condition was found in mucous membrane of colon, which was distended with yellowish grumous fœces. Careful examination was made as to the presence of ulcers in the bowels, hitherto without success. Probably the lung complication came on at an early stage of the enteric disease, which would account for the absence of the lesion.

In the case of a horse of the Rev. Mr. Walsh, Chaplin to the Forces, gastro-enteritis existed, the signs of inflammation being more marked in small intestines where the mucous membrane presented a dark red colour with adema of tissue beneath. The colon was in the condition referred to in preceding paragraph. The rectum was also inflamed. Blood had also escaped from the anus before death and seemed to have been due to extravasation as no ulcerated point was detected. Death was due to hyperæmia and adema of lungs. The animal was purchased as a "salted horse."

Symptoms.

It is a curious feature in these acute pulmonary attacks that cough is not by any means a prominent symptom. As pleurisy is a

frequent concomitant of the disease it is probable that the pain due to it and its aggravation on coughing may prevent the act. Usually, the first sign of the horse's sickness is his being heavy and sluggish, and when with difficulty forced to move briskly the animal soon shows exhaustion, and heaving of the flanks is observed. Puffing of the supra-orbital cavities is also, in many instances, seen early in the attack.

On one occasion when riding into Fort Weeber with the D.A.Q.M.G. of Headquarters and Interpreter, the former called attention to the good condition and appearance of his pony. The Interpreter remarked the puffing above the animal's eyes, and that this was a sign of sickness. Next day fever, with broncho-pleuritis, set in; respirations 56, temperature 104.5°, with white, and afterwards rusty, froth from nostrils. As congestion of lungs was progressing he was bled to 2½ pints, and counter-irritants applied over lungs. Marked relief, and subsequent recovery, took place. During several days the temperature was taken morning and evening, and a remission to the extent of about two degrees in favour of morning range was found. As a similar remission took place in other cases, this fact connected with looseness of bowels which also existed are strongly suggestive of the presence of enteric fever. The most constant prominent symptom is, however, the increased rate of respiration and seems rapidly to follow the rise of temperature. The tawny discolouration of conjunctivæ and the lividity of mucous membrane of mouth are also signs of the attack, and prove that blood deterioration is in progress. An offensive smell from the mouth is often detected. When the hyperæmia is established the rise of temperature is rapid and marked.

A horse of W. H. Russell, LL.D., had been ridden very quickly while out with a reconnaisance from Fort Albert Edward to Umquana's Kraal was, on return, attacked with congestion of the lungs. Respiration over 60, temperature 105.2°. Bleeding to three pints reduced it to 104.2°, and relieved the dyspnœa. In the evening the temperature fell to 102°; signs of pleuro-pneumonia came on the next day, and he was left behind the column at Fort Albert Edward. When seen about a week after he was recovering, but as the temperature (102°) proved that fever was still present, he was left there to be sent to Pretoria when fit for the journey. At an early stage of congestive bronchitis, should the hyperæmia have resulted in it, white froth is frequently seen to issue from the nostrils. It is evidently bronchial mucous intimately mixed with air in the minute tubes. The secretion much resembles the mixture of white of egg with sugar which cooks whip into a decoration for their sweet dishes, and called "trifle." The discharge as the diseases advance becomes yellow, and, subsequently, rusty from intimate mixture with blood. In most cases the action of the ribs with respiration is much decreased from the cause stated as a reason for the absence of cough. The supplementary action of the diaphragm is notable.

The swelling of the glands of throat and adema of cellular tissue of head, including the puffing of supra orbital fossæ, which are symptoms in some forms of the illness, are probably merely external indications of the hyperæmia which is also present in the bronchial and pulmonary circulation. This is more obvious in the fore part of the animal in consequence of the compression of abdominal vessels by the great flatulent distention of bowels, a frequent concomitant of the malady.

Relative to the physical signs in lung, in several cases pleuritic friction was heard. The percussion note was not much dulled; bronchial rales occasionally were found, but the respiratory sounds during life scarcely yielded a decided indication of the intensity of the disease as revealed by the examination after death.

As regards the state of bowels and *prima via* generally, in cases of hyperæmia and the milder cases of bronchitis, there was no marked deviation from the natural state; even in some instances horses were to graze a short time before death from congestive bronchitis. When symptoms of enteric were present, constipation, and, more frequently, diarrhœa, existed; the fœces like a mixture of bruised mealies and water. A few cases of colic were observed.

That the germs of typhoid disease were derived from the water was rendered probable by the fact that, when Baker Russell's column was encamped on the Pokwana Hills, six miles from Fort Weeber, there were among the troops several admissions with enteric. As far as the site, the camping ground was unexceptionable. The water supply was from a spruit which took its course over decomposing granite—its source, more an ooze than a spring, about a mile from camp on the hill side, mealie fields, small morasses and uncultivated ground the nature of surrounding ground surface. The water, to appearance and taste, was fair.

At Fort Weeber, where a considerable force had been stationed for some time, although the place was kept as clean as practicable, still the soil around was fouled by excrement of men and animals, and the debris of carcases, and the situation itself far inferior to that on which Baker Russell's column was encamped; still, with one doubtful exception, there were no cases of typhoid contracted there, as I was informed by Surgeon Brannigan, and he believed that the case referred to might have received the infection elsewhere as he had been away from the fort on duty previous to the attack. The water supply here was from two wells which were carefully protected from any pollution; the water appeared to come from a considerable depth; the temperature was higher than the air, and there was a sulphurous smell and taste. It has also been stated that, when the 13th Regiment marched to Pretoria, cases of typhoid contracted on the high veld appeared soon after the arrival of the corps at the Capital.

From a consideration of foregoing, it is suggested that the diseases from which the horses suffered during the Sekukuni campaign, and subsequently, may be classified as follows:—

1. Hyperæmia of lungs.
2. Bronchitis, becoming congestive after much exertion or exposure to cold and wet.
3. Bronchitis frequently complicated by pleurisy and, occasionally, by lobular pneumonia, and those affections secondary and intermixed with entero or ileo typhus.
4. Fever of continued type; duration unknown.

In addition to above, a few cases of febricular or ephemeral fever were observed. In these there was high temperature—105°—and quickened respiration. This state was probably induced by the heat and exposure to sun; it lasted but for a few hours and disappeared within the day.

TREATMENT.

In some instances the means employed by residents would be amusing but for the suffering entailed. A clergyman who was Acting Chaplin to the Forces stated that, having a horse ill, he consulted a Dutchman who was supposed to have a remedy. He commenced the treatment by making the animal jump backwards and forwards across the desselboom of his waggon until the horse fell dead. This energetic treatment was found occasionally to relieve mules suffering from colic, but was certain to hasten the fatal termination when lung disease existed.

A distinguished officer of irregular cavalry placed great faith in a dose containing a piece of blue-stone the size of a thumb in a half-pint of gin.

Whatever may be the basis, gin usually appears as the menstruum for the remedy. It has also been stated by some that they believe they had a patent cure, and this had almost succeeded in saving the horse.

From the symptoms during life and the examination in fatal cases it was clear that hyperæmia or its consequences was the morbid action most to be combatted. When the pulmonary engorgement was progressing, blood-letting from the jugular vein was found to afford marked relief. It would appear that the beneficial action was more decided when the hyperæmia was, it may be termed, primary, and as a result of violent exertion or causes due to climate or exposure than when the congestion was occurring in an animal suffering from bronchitis or the engorgement symptomatic of enteric fever.

Mr. Wiltshire recommends "that bleeding should not be had recourse to unless the breathing be very difficult." Would it not be better to anticipate this state when probably the hyperæmia may have resulted in adema of lung Mr. Wiltshire has also called attention to the use of the clinical thermometer as "an unerring guide in the earlier stage when outward symptoms are not to be relied on, and as giving time to adopt treatment which, in many cases, may be successful." Agreeing with him as to the important information afforded by the employment of the thermometer as it not only, in most

cases, decides the fact that fever is present, but also its degree, the rate of respiration with the condition of mucous membrane of mouth, and colour and state of conjunctivæ come next as factors to determine the imminence of pulmonary congestion.

For example: If the horse—the immediate effects of exercise over—have rapid breathing, 40 and upwards, temperature 103° or higher, pulse 70 or higher, with congestion and discolouration of conjunctivæ, unhealthy, livid appearance of mucous membrane of the mouth, it is suggestive that blood-letting to at least three pounds with an abstraction of an additional pound for each degree above 103 would be attended with benefit, and, in fact, in the cases met with which were treated in this way, the practice in nearly every instance was successful. Venesection, as stated previously, employed when the congestion is secondary or dependent on existing disease, whether bronchial or enteric inflammation, requires consideration as to the necessity and extent to which abstraction of blood is useful. The great point, however, to be attended to is the employment of the remedy early in the disease. There are probably but a few hours from the time congestion sets in before grave lesion takes place in the lung, which renders medical aid of but little avail. An animal dying from suffocation is a pitiable object compared with one in a similar state from most other causes, and bleeding, when practicable, even though not curative, allevoates these urgent and distressing symptoms. Death from debility is comparatively easy.

Counter-irritation is also a valuable remedy in cases of horse sickness, with symptoms described in the foregoing pages. In hyperæmia of lungs it would assist in relieving the congestion and in preventing further morbid action. In most of the examinations after death the signs of pleurisy existed in a greater or less degree, and, in cases of this kind, counter-irritation would certainly tend, if not to lessen the inflammatory action, to prevent effusion of fluid or plastic materials on the serious membrane or the collateral hyperæmia of the lung. Like venesection, the sooner blistering or stimulation of skin be used after the accession of attack the better; the same rule applies to bronchial inflammation. When there are reasons to suspect enteric disease to be present, the external stimulation should extend both over lungs and abdomen.

Mr. Wiltshire recommends hot fomentations to chest or mustard as a counter-irritant, and considers these applications better than euphorbia. Mr. Glover, R.A., advises a mustard plaster or turpentine liniment, the latter to be rubbed with considerable friction to both sides of chest, on the throat, and to the under part of neck. Sir Morrison Barlow, Commissioner of Zoutpansberg, stated that he saw most unpromising cases of horse sickness recover after the application of a liniment composed of the juice of the euphorbia and oil of turpentine; the action is almost immediate and intensely stimulating, and should be applied with flannel or cloth tied on a stick, not with the hand.

As a rule, during the period embraced in this report, mustard and turpentine were used either singly or conjointly for external application and were found to answer.

Rest is the next element in the treatment to which attention is called. It is a matter of considerable difficulty to decide as to the presence of fever; there are reasons to doubt that the thermometer will give in all cases a perfectly reliable answer. In enteric fever in this country some instances have occurred both in the human subject and in the horse when a temperature presenting the character of the initial stage of typhoid remained high for a couple of days, then fell to normal standard, and, after a short intermission, again became high, and the case presented the distinct feature of enteric. To decide as to the absolute necessity for rest, the state of mucous membrane and evacuation should be carefully noted. Surgeon Brannigan also observed this unusual feature in the early stage of enteric among some of the patients at Fort Weeber.

A large proportion of the horses examined after death showed that congestion of the bowels had existed for at least several days, but that the lung complication which proved fatal had been due to the animal having been out and exercised more or less quickly not many hours before the pulmonary attack commenced.

The therapeutical means directed against this disease are vast and varied, but with little success. Each colonist, and many others, have their pet mixtures, of some of which the composition is unmentionable and have to be given in a certain way, otherwise the effect is lost.

After observing the symptoms of the disease, and appearance after death of the various organs, the most rational treatment presents itself in the withdrawal of blood in the early stages of the attack, which tends to relieve the distended vessels, lower the action of the heart and check the rapid progress of congestion of the lungs which is evidently the immediate cause of the sudden death, the congestion of the lungs being the result of the enteric affection.

Again, at the commencement of the attack, when the pulse is rapid and strong, medicine with a sedative action should be given, together with febrifuges, in which Fleming's tincture of aconite in from 10 to 20 drop doses answers both. Again, powdered digitales or the extract of belladona are valuable medicines given in half-drachm doses.

When the disease is further advanced and the pulse becomes feeble and the animal weak, stimulants are to be given. The aromatic spirits of liquor ammonia, alcohol in its various forms, are all medicines with a stimulating action. Camphor is also a useful medicine in this disease.

As mentioned before, counter-irritation is a most valuable therapeutic in this disease. The chest and abdomen should be well fomented with hot water—not merely warm—for half-an-hour or so, then good mustard, turpentine, liquor ammonia, or all combined, applied to the parts—chest and abdomen—with smart friction, will

be found sufficiently strong without having recourse to euphorbia, the irritant properties of which are second only to the actual cautery.

Treatment in various forms may be laid down and a few cases may recover when the attack has not been virulent, but, when the disease has once established itself, or if the animal be exercised or worked while suffering from an attack of the fever, treatment is of little avail and a specific cure is out of the question.

Prevention is what the owners of horses must turn their attention to, which, to a great extent, will be found in comfortable stabling, careful feeding, watering and grooming and reasonable working. Horses well cared for are not so likely to die from the disease as those subjected to ill-treatment. Some people in this country and in Pretoria take great care in the stabling and feeding of their horses, and they seldom lose any. But when horses have to pass through badly watered, malarious districts, on long journeys, this malignant fever of enteric type will continue to denude the traveller of his most rapid means of transport yet in this country.

Among the fatal cases were some horses which were said to be "salted," although these were supposed to have an immunity from horse sickness.

The question arises as to the constitutional state of an animal so protected. According to some persons, a "salted horse" is of an uninviting appearance, sluggish, and rough-coated, and, when the skin of neck is pinched, a wrinkle marks the place for some time; ears pendulous; more or less touched in the wind.

The Chief of the Staff naively remarked, "this is perhaps the only country in the world where the fact that a horse is broken-winded doubles his value." This desirable state is probably the result of previous, the chronic state of which has terminated in pulmonary emphysema. A beast with this affection will certainly give timely notice before he exceeds his powers of speed or endurance.

In the next place, horses that have suffered from enteric fever—should these surmises as to its far from uncommon existence in this country be correct—will, in all likelihood, possess in a very limited degree a susceptibility to a recurrence of the disease.

In addition to these protecting agencies, a horse will probably become acclimatised as described in the commencement of this report; it is doubtful, however, whether any period of residence would protect an animal from the morbific action of typhoid germs.

Relative to precautionary measures, perhaps the rule most general in its application to animals either in a state more or less influenced by a change of climate or physical changes of atmosphere, as well as in those where the first morbid action of typhoid or other septic poison in producing constitutional effects, is not to over-ride or over-drive them. Under no circumstances could the old saying, "'Tis the pace that kills," be a more marked truism than in the cases referred to.

A question suggests itself as to the propriety of taking blood from a working animal on or before reaching an altitude much above that previously occupied; however, it would have one good effect that

an operation of the kind would entail for a few days at least additional care in the direction of over-work.

Should the prevalence of enteric disease receive confirmation, it is almost needless to insist on the paramount importance of good water. There would surely be no difficulty in sinking wells at stated distances along the main routes where the water in the natural channels was found to be impure. Boiling the water even from these would, it is believed, destroy the typhoid germs, but, as for long distances across the veld, wood is not to be had, this means of preventing disease would, it is to be feared, be almost impracticable.

In conclusion, it is to be hoped that the question raised in this paper may meet with further investigation. According to the Colonial Veterinary Surgeon, Mr. Wiltshire, the origin of the disease is obscure and its investigation difficult. It is his opinion "that it is not peculiar to the horse, but also attacks the mule quagga, and there were reasons to think the wildebeeste also suffered from it."

It is stated the ass escapes; his accurate perception of the quality of the water may exceed the delicacy of chemical analysis. However, the number and variety of animals affected point to some common source of infection which may also involve human beings.

The symptoms do not favour the view as its origin in or from the herbage, and, among the horses of Headquarter Staff, although fed on oat hay and corn for several weeks before the return of the Force to Pretoria and subsequently, several fatal cases of horse sickness occurred. It is very improbable that the disease is due to any specific irritating quality of the air in this part of south-eastern Africa, which enjoys a well-deserved fame as to its salubrity for the human race, especially as regards immunity from bronchial and pulmonary affections, and why any difference between man and animals should exist in this respect it is difficult to imagine.

The fact that water may be a source of disease appears to be counted of little importance; even in Pretoria the open state of the sluits which supply the inhabitants with water for drinking and other purposes is surely a source of danger. Animals cross these streamlets at numerous points, and that the water is frequently fouled in this way is quite palpable.

(Signed) R. W. JACKSON, S.M.
R. MOORE, M.R.C.V.S., A.V.D.,
King's Dragoon Guards.

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VETERINARY NOTES.

By Rodney H. Williams.

East Coast Fever in Natal.

Previous to the native disturbance, *i.e.*, March, 1906, the Veterinary Department of Natal had East Coast Fever in that Colony well in hand, the disease only being active in the Paulpietersburg and

Ngotshe Districts (which includes Louwsberg), at one time part of the Vryheid District, where the disease broke out in November, 1905. Immediately the native trouble commenced in Natal both Europeans and natives found it necessary to remove their families to places of safety, and their only means of accomplishing this was with ox transport. Consequently, numerous unauthorised movements of oxen were made which otherwise would not have been made, with the inevitable result that the infection of East Coast Fever was spread rapidly, and all the good work done by the Veterinary Department was rendered of little or no avail. Another factor in the spread of the infection were the looted cattle which were collected in Zululand until the close of hostilities and then dispersed all over Natal, which accounted for the appearance of the disease in Dundee. Then again, cattle were illegally moved from Vryheid and traced as far as Durban County, while oxen discharged from the militia service at Stanger carried the infection to Weenen Division. Before the Native Rebellion broke out there were only thirteen outbreaks of East Coast Fever in existence. At the time of writing there are 171 outbreaks, which are situated as follows:—

Vryheid, 90 ; Zululand, 28 ; Dundee, 22 ; Paulpietersburg, 15 ; Durban and Umlazi, 9 ; Weenen, Umvoti and Inanda, 2 each ; Alexandra, 1 ; whilst the Mapumulo and Lower Tugela Districts are each looked upon as one infected area. From these figures it will be observed that the disease has spread south as far as Alexandra, which is south of Durban, west as far as Dundee, east as far as Hlabisa, in Zululand, and north to Vryheid, which borders on the Transvaal.

The Transvaal Veterinary Department exchange weekly reports with the Natal Veterinary Department on the progress of the disease, and in addition are notified by wire of any fresh outbreak.

Owing to the spread of the disease in Natal, the following regulations preventing the importation of cattle from Natal were drawn up and published under Government Notice 31 of 1907 :—

"Under and by virtue of the powers in him vested by Section 4 of the Diseases of Stock Ordinance, 1902, His Excellency the Acting Lieutenant-Governor has been pleased to prohibit, until further notice, the importation of cattle from the Colony of Natal into this Colony, with the exception of stock entering under permit from oversea and passing through Natal by rail direct ; provided that notwithstanding such prohibition, slaughter cattle for which permits have, at the date of this notice, been issued under Regulation 8 of the Regulations published under Government Notice 1288 of 1906, shall be admitted subject to the terms of such Regulations.

"Government Notice 1287 of 1906 shall be and is hereby withdrawn."

THE CHEMICAL SECTION.

I.] NOTES ON SOUTH AFRICAN FOODSTUFFS.

By Herbert Ingle, B.Sc., F.I.C.. F.C.S.

In the last number of the "Journal,"* I discussed at some length the functions of the ash constituents of plants, and among other things, called attention to what I consider a grave error in the practice of feeding draught animals upon an exclusive diet of cereals.

The particular point I endeavoured to make clear was, that such a diet did not adequately supply the needs of animals with respect to bone-forming materials, especially lime and phosphoric acid.

The subject is of such importance and has raised such interest that even at the risk of some repetition, I have thought it well to again refer to it and to give some additional reasons why the usual methods of feeding adopted in this country are unsuitable and probably conducive to injury to the animals.

Let us then consider the two foodstuffs, oathay and mealies, which form the almost universal food of horses and mules in this Colony.

In doing so, there are two chief aspects from which they may be viewed :—

I. As foods in the ordinary sense, *i.e.*, considering only their organic constituents, and their power of supplying protein, carbohydrates and fat.

II. As to their power of supplying all the needs of the animals.

I. Foodstuffs are usually valued according to the proportions of :—

1. Nitrogenous substances—proteids or albuminoids.
2. Carbohydrates—starch, sugar, etc.
3. Fats.

Now, this aspect of the question has been investigated many years ago, and the importance of supplying these three classes of food constituents in proportions suitable to the special requirements of the animals has been fully recognised (*vide* this "Journal," July 1906, Vol. IV., pp. 812–818) in Europe and America.

The proportion of nitrogenous materials to non-nitrogenous substances expressed as starch, is known as the "albuminoid ratio," or "nutritive ratio" of the ration, and it is found necessary to so adjust the ration that this ratio has approximately a certain fixed value (which, however, varies with circumstances), if the most successful results are to be obtained. However, as the method of calculating albuminoid ratios has already been described in this "Journal" in the article referred to above, further reference is not here required.

* Vol. V. (April, 1907), pp. 647 to 656.

The following represent what have been found by experiment to be the most suitable "albuminoid ratios" in the rations for various purposes:

For very young animals	1 :	4·0
For oxen at rest	1 :	11·0
For oxen moderately worked	1 :	7·5
For oxen heavily worked	1 :	6·0
For horses moderately worked	1 :	7·0
For horses heavily worked	1 :	5·5
For cows giving little milk	1 :	6·0
For cows giving much milk	1 :	5·0
For sheep for wool production	1 :	8·0
Fattening sheep cattle and pigs	1 :	5·5
For laying hens or ducks	1 :	4·0

Animals undergoing hard work require more nitrogenous food than those at rest, in order to permit of the renewal of the tissue which wastes more rapidly, while young growing animals or those giving milk obviously require more of the tissue-forming material—proteid—than adult resting animals. If, in a particular instance, the ration of an animal possesses an albuminoid ratio much "wider" or "narrower" than that most suitable, then either waste of some constituent of the food occurs, or the requirements of the animal are not supplied and its health suffers.

Now, in a sample of oathay grown in the Potchefstroom District we found:—

Moisture	8·25
Ash	4·23
Protein..	5·65
Fat	3·87
Crude fibre	34·22
Carbohydrates	44·03
	100·00

This would give an albuminoid ratio of about 1 : 9·4,* assuming that the various food constituents are equally digestible. Now, by comparison with the table given above, it will be seen that this ratio is too "wide" for the requirements of working animals.

Nor does the addition of mealies to the diet improve it, for the albuminoid ratio of mealies is about the same.

Working horses or mules, therefore, fed upon an exclusive diet of oathay and mealies are receiving, either too little nitrogenous matter for their requirements, or, if they eat more of their food, are taking more fats and carbohydrates than they require.

This is undoubtedly a wasteful method of feeding therefore, and is also very liable to injure the health of the animals. It can be most readily amended by the substitution for a portion of the oathay of some foodstuff with a "narrower" albuminoid ratio, *i.e.*, of some product richer in

* It is perhaps only fair to say that the proportion of protein in oat-hay is apparently liable to great variation and is frequently much higher or lower than in the example given.

nitrogenous material. Lucerne hay, clover hay, peas, beans, bran, or various oilcakes would be suitable foods to effect this narrowing of the albuminoid ratio, but other less concentrated and perhaps cheaper foods, *e.g.*, meadow hay, teff hay, might be used. In the "Journal" for July, 1906, pp. 813–815, was given a table showing the average composition of the common foodstuffs from analyses made chiefly in Germany and America, and from these tables it can readily be seen which foods are rich in protein and from the figures the albuminoid ratios can be calculated.

It may, however, be useful to give the albuminoid ratios of a few typical foodstuffs:—*

Food.	*Albuminoid ratio.*
Mealies (Soft, Transvaal grown)	1 : 9·6
Mealies (Dent, Transvaal grown)	1 : 9·2
Mealies (Flint, Transvaal grown)	1 : 8·0
Oats, grain	1 : 6·0
Wheat, grain	1 : 6·4
Barley, grain	1 : 6·0
Kaffir corn	1 : 8·2
Millet	1 : 5·7
Buckwheat	1 : 6·1
Horse beans	1 : 2·0
Soy beans	1 : 2·0
Peas	1 : 2·7
Cow peas	1 : 2·8
Linseed	1 : 5·1
Meadow hay (English)	1 : 4·9
Lucerne hay	1 : 2·3
Natal blue grass hay	1 : 10·2
Boer manna hay (Transvaal)	1 : 10·1
Teff grass hay (Transvaal)	1 : 7·7
Linseed cake	1 : 2·0
Cocoanut cake	1 : 3·2
Peanut cake	1 : 0·9
Bran	1 : 3·6
Rhodes grass (Transvaal)	1 : 3·5

II. But there is another important aspect of foodstuffs, and that is as to their suitability to supply the materials for the formation of bones in the animal. This point, however, was dealt with in the last number of the "Journal" (April, 1907, pp. 647–656), and is again referred to in the latter part of the Chemical Section in this number.

The low proportion of lime to phosphorus pentoxide which characterises oathay and mealies may be most readily corrected by the addition of lucerne hay to the diet, but other fodders obtainable in this country would, from this point of view, be much preferable to oathay.

* These figures are, in the case of forage crops particularly, somewhat misleading, as the "crude fibre" has been assumed to be indigestible, which is not entirely the case.

Thus, Boer manna hay, Natal blue grass hay, teff grass hay, or Rhodes grass would all tend to increase the ratio of lime to phosphorus pentoxide, if used instead of a portion of the oathay. The ratio of lime to phosphorus pentoxide which in the ration of animals probably ought not to be much less than 1 : 1 is, from the results of our and other analyses, as follows in the various foods :—

Oathay (Transvaal)	0·51 : 1
Mealies	0·04 : 1
Boer manna hay (Transvaal)	0·94 : 1
Natal blue grass hay	1·68 : 1
Teff hay (Transvaal)	1·26 : 1
Bran	0·09 : 1
Linseed cake	0·26 : 1
Rhodes grass (Transvaal)	2·52 : 1

It will be noticed that some of the foods mentioned in the above list, *e.g.*, bran and linseed cake, which are rich in ash and therefore generally regarded as being particularly useful in supplying the materials for bone formation are, from the point of view here explained, particularly unsuitable for this purpose, because of the large proportion of phosphorus pentoxide to lime which they contain.

The injury to the bones of animals fed largely upon bran has been noticed in the disease known as "bran rachitis," or "miller's horse disease," and in some respects the effects produced resemble osteoporosis.

SUMMARY.

Oathay, or oathay and mealies, are not suitable as the exclusive diet of working horses and mules, for two reasons :—

1. Such a diet is not rich enough in nitrogenous matter in proportion to carbohydrates and fats to properly supply the requirements of the animals.
2. The diet is defective in its capability of supplying materials for proper nourishment of the bones of animals and thus is favourable to the production of bone diseases.

The first objection could be overcome by the addition to the ration of any food with a narrow albuminoid ratio, *e.g.*, lucerne, oil cakes, bran, peas or beans, or by employing meadow hay or teff hay in place of a considerable portion of the oathay.

The second objection could be removed by the addition to the ration of lucerne hay, clover, meadow hay, Natal blue grass, or teff hay, but not by the addition of linseed cake, bran, or even beans or peas.

In conclusion, I would strongly advise horse and mule keepers to give more consideration to the choice of food and to try on the large scale the effect of substituting for the oathay, now so largely used, some of the foodstuffs here recommended. The farmer would then probably find a ready market for other varieties of forage, which could easily be grown in this country, and I feel practically convinced that the health and condition of our animals would be enhanced, and the heavy losses from certain diseases would be considerably diminished.

ABSTRACTS AND REVIEWS.

Practical Agricultural Chemistry, by F. D. S. Robertson, F.C.S., London; Baillière, Tindall & Cox. 7s. 6d. nett.

This is described on the title page as a "Manual of Qualitative and Quantitative Analysis for Agricultural Students." The book contains a large amount of information concerning analytical methods, but much of it is of a very empiric character

As a reference book for bare analytical details, covering a great range of subjects, the work may be useful, but as a manual for agricultural students, it is, in our opinion, far too empiric and lacking in explanation of the chemistry of the reactions involved, to be satisfactory. The illustrations, printing and general get-up of the book are very creditable to the publishers.

The Fertility of some Colonial Soils, as influenced by Geological Conditions, by C. F. Juritz, M.A., F.I.C., Senior Government Analyst to the Department of Agriculture, Cape of Good Hope. This paper appears in the April number of the "Cape Agricultural Journal."

It gives the results of the analyses of 204 samples of soils collected from various parts of Cape Colony during the past 12 years.

In the tables of analyses, however, only the proportions of water, organic matter (apparently loss on ignition, which probably includes some "combined water," *e.g.*, in clay), lime, potash and phosphorus pentoxide are given. No determinations of nitrogen, nor of magnesia, insoluble matter, iron oxide and alumina are given, nor do the amounts of "available plant food" appear to have been determined.

From the figures given it will be seen that the soils of Cape Colony, on the whole, resemble those of the Transvaal in being poor in lime and phosphoric acid, but differ in being much poorer in potash.

The average of the analyses gives for phosphoric acid ·065 per cent., which is almost exactly equal to the mean of about 200 samples of Transvaal soils examined in our laboratories during the past three years. The average for lime in the Cape Colony soils is about 0·56 per cent., but, excluding seven soils in the Campbell Rand series (4·169 per cent.) and two soils in the Dwyka series (1·013), the mean for the remainder is only 0·191 per cent., or if all averages above 0·25 per cent. be excluded, the mean for the remaining 110 soils is 0·075 per cent of lime.

In our analyses of Transvaal soils, the average amount of lime is about 0·81 per cent., but excluding those above ·25 per cent. (and some samples contained as much as 30 per cent. of lime), the remaining 98 samples give an average of only 0·098 per cent.

In potash the Cape Colony soils are apparently much poorer than our Transvaal ones; the mean of those given by Mr. Juritz being 0·104, while in the Transvaal, 0·23 per cent. appears to be about the average, some specimens containing as much as 0·91 per cent.

As already stated, it is to be deplored from an agricultural standpoint, that no determinations of the amount of nitrogen, upon which fertility

so largely depends, were given, but doubtless the fact that the paper was written mainly from the geological standpoint accounts for this omission.

On Osteoporosis in Animals, by Herbert Ingle, B.Sc., F.I.C. This article appeared in the "Journal of Comparative Pathology and Therapeutics (March, 1907, p.p. 35–48).

The paper contains the results of the chemical examination of the bones of horses, mules and donkeys, some of which had suffered from the disease, while others were in normal health.

It is clearly shown that the bones of animals affected by the disease are poorer in total ash, in lime and in phosphoric acid than those of healthy animals.

Thus with the bones of three healthy mules, the following figures were obtained :—

No. of Animal	547	548	597
Moisture	5·43	4·98	5·61
Organic matter	36·71	37·19	39·40
Ash	57·86	57·83	54·99

While with the bones of four mules suffering from osteoporosis :—

No. of Animal	523	631	633	634
Moisture	6·17	5·68	6·39	6·18
Organic matter	44·19	42·19	41·96	43·05
Ash	49·64	52·13	51·65	50·77

Similarly with the bones of four donkeys, all suffering from the disease, the figures were :—

No. of Animal	635	636	638	639
Moisture	6·51	6·66	5·64	5·33
Organic matter	44·47	47·52	49·08	43·40
Ash	49·02	45·82	45·28	51·27

In the case of two horses, one No. 470, healthy, the other No. J.R. diseased, the bones, after correcting for the very different quantities of fat present gave in the fat-free bones :—

	No. 470.	*No J.R.*
Moisture	5·5	7·2
Organic matter	35·7	38 0
Ash	58·8	54·8

Here in both cases, the proportion of ash is much higher than in the other results, because of the correction for fat, but obviously No. 470 is much richer in ash than No. J.R.

The best method of comparison is, however, the ratio of nitrogen (which is a direct measure of the amount of the nitrogenous constituent —the *ossein*) to ash.

The ratios in the various animals were as follows :—

Healthy animals	Mule 547	.. .. 1 : 15·6	Mean = 1 : 14·37	
	Mule 548	.. .. 1 : 13·8		
	Mule 597	.. .. 1 : 13·5		
	Horse 470	.. .. 1 : 14·6		
Diseased animals	Mule 523	.. .. 1 · 11·6	Mean = 1 : 11·12 or leaving out No. 639 1 : 10·8	
	Mule 631	.. .. 1 : 11·6		
	Mule 634	.. .. 1 : 11·4		
	Mule 633	.. .. 1 : 9·8		
	Horse J.R.	.. .. 1 : 10·4		
	Donkey 635	.. .. 1 : 11·7		
	Donkey 636	.. .. 1 : 10·1		
	Donkey 638	.. .. 1 : 9·8		
	Donkey 639	.. .. 1 : 13·7		

With the exception of Donkey 639, these figures are very consistent. The results for this animal (No. 639) were in other respects more like those for healthy animals, and it is quite probable that the disease was in this case either not so severe or not so far advanced as with the other diseased animals.

Though no organism has been detected as associated with the disease and attempts to communicate it to healthy animals by inoculation or the administration of diseased bones have resulted in failure, there is a strong opinion held by many veterinary surgeons that the disease is of parasitic origin. Another widespread assumption is that the disease is caused or favoured by a deficiency of mineral matter—particularly of lime and phosphoric acid—in South African grown forage.

The writer puts forward the theory that it is not the lack of phosphoric acid and lime in the food, but rather the unsuitable proportions in which these are present which is the great predisposing cause of the disease.

The usual rations of horses and mules in South Africa are made up of oathay or oathay and mealies, and it is pointed out that both these foodstuffs contain far too much phosphoric acid in proportion to lime for the probable requirements of animals for healthy bone formation.

In Europe and most other parts of the world where oats are used as food for draught animals, meadow hay or clover hay is given in addition, and thus the ratio of phosphoric acid to lime in the whole ration is greatly diminished.

In bones the ratio of phosphorus pentoxide to lime is approximately 100 : 150, and it will probably be safe to conclude that in the whole ration of an animal the proportion of phosphorus pentoxide to lime ought to be about 100 : 100, *i.e.*, that there should be at least as much lime as phosphorus pentoxide in the ash of the food.

In oathay this ratio is :—

100 : 69 (Wolff).
100 : 61 (Warington).
100 : 51 (Mean of analyses of South African samples).

While in mealies the ratio is :—

100 : 4.

It is clear, therefore, that animals fed upon oathay or oathay and mealies, receive in their food far less lime than phosphorus pentoxide, and the writer suggests that this is the main predisposing cause of the prevalence of bone diseases in this country.

In the forage used in Europe, etc., for draught animals, a much higher proportion of lime to phosphorus pentoxide is present, as is seen by the following ratios, calculated from analyses by Wolff :—

	Phosphorus pentoxide.		*Lime.*
Lucerne	100	:	478
Red clover	100	:	360
White clover	100	:	228
Meadow hay	100	:	227

Details of experiments made in 1891 by Weiske with rabbits are given, in which it is shown that the use of foods rich in phosphoric acid and poor in lime produced a very brittle light condition of the bones, while control animals fed on a diet rich in lime developed large strong skeletons. Moreover, the results obtained at the Wynberg Camp, near Capetown, in 1898–9, in the treatment of animals suffering from osteoporosis, afford strong confirmation of the truth of the theory, though the treatment there adopted—viz., the replacement of oathay by lucerne hay and green forage, and which proved so successful—was adopted without any recognition of the principles here enunciated.

In conclusion, the practical deductions to be drawn from the paper are, that the susceptibility to bone disease in horses, mules and donkeys would be greatly diminished if the present exclusive diet of oathay or oathay and mealies were replaced, to some extent at least, by lucerne hay, or probably even veld hay, and that a recognition of the need of supplying bone-forming materials—lime and phosphoric acid—*in proper proportions* in framing rations for animals would undoubtedly lead to greater success in producing sound and healthy stock than at present attends the usual methods of feeding adopted in this country.

THE BOTANICAL SECTION.

THE SOUTH AFRICAN LOCUST FUNGUS.

By I. B. Pole Evans, B.A., B.Sc (Acting Botanist and Plant Pathologist).

For more than ten years now it has been known that locusts in South Africa have occasionally succumbed to a fungus disease.

The hopes of agriculturists have thus been again and again raised, that some real advantage might accrue to them if the fungus was cultivated and distributed on an extensive scale by Government. Numerous enquiries on this point have been made this year, as one would naturally expect owing to the vast swarms of locusts which have devastated our Colony.

The past season has been particularly favourable in affording me an opportunity of going into the matter, as some thousands of red locusts (*Cyrtocanthacris septemfasciata*, Kirby) affected with fungous disease, procured from various parts of the Eastern Transvaal and its borders have passed through my hands. Up to the time of writing, in every specimen examined, I have found one and the same fungus present. This fungus is known botanically as *Empusa Grylli*, Fres., and agrees in every respect with the descriptions given of the same fungus which is found in Europe and several other parts of the world on locusts and other insects.

The characteristic feature about locusts attacked with this fungus is that they crawl up to the tops of grass or other vegetation, where they remain clinging long after death. The fungus appears externally on the locusts chiefly between the joints of the abdomen, as a short buff-coloured furry growth. When this is examined under a microscope, the buff-coloured mass is found to consist of a number of short, stout, tubelike growths, as is shown in our drawing. The ends of these tubes or *hyphae* as they are technically called, swell up into ovoid or pear-shaped bodies, the spores, which through a mechanical device are projected off with such suddenness, that they are thrown to a considerable distance, when if they happen to strike the body of another locust may infect it, and thus the disease is spread. Before proceeding further, perhaps it would be well to pause for a moment and say a few words regarding the nature of the fungi to which *Empusa Grylli* belongs

In the domain of fungology, it is usual to distinguish two groups of fungi, known respectively as *saprophytes* and *parasites*. A saprophyte is a plant or fungus which lives on dead organic matter, while a parasite is a plant or fungus which lives on or in and at the expense of another living organism. Saprophytic fungi are further distinguished as *Pure* or *Obligate saprophytes* and *Facultative saprophytes*. Pure or obligate saprophytes live entirely on dead organic matter, while facultative saprophytes are fungi which normally go through the whole course of their development as parasites, but which can at certain stages grow as saprophytes.

Parasites likewise fall into two classes: *Facultative parasites* and *Obligate parasites*.

Facultative parasites are fungi which can and normally do go through the whole course of their development as saprophytes, but which may also go through their development wholly or in part as parasites. Obligate parasites, on the other hand, are fungi to which a parasitic life is indispensable for the attainment of their full development. Many fungi living in insects belong to this last mentioned class. The several species of *Empusa*, including *Empusa Grylli*, the locust fungus mentioned above, are strictly obligate parasites, and go through the whole course of their development, with the exception of a brief stage of germination, in and on the insect while it is either still alive or recently killed, by their vegetation.

From a series of experiments just carried out with this fungus in my Laboratory at Pretoria, I have only been able to cultivate it through the medium of living locusts, all attempts to grow it successfully on the ordinary artificial media have failed. The experiments prove that healthy locusts inoculated with the fungus become very sluggish on the fourth day and usually die on the fifth or sixth day, when the furry buff-coloured growth appears. It was found impossible to obtain such growths by inoculating the healthy bodies of dead locusts. Thus it will be realised that *Empusa Grylli*, the locust fungus, is entirely dependent for its growth on the living tissues of the locust, and cannot as far as is known be cultivated on artificial media.

It is quite likely that some people—so-called "practical people"—may say to themselves "what does it matter what the fungus is or what it is technically called?"

In this article we shall endeavour to show that such points even if they are of purely scientific interest may nevertheless be of no little economic value, and had they been appreciated before would have saved this country much expense to say nothing of raising false hopes.

The history of the South African Locust fungus is as follows:—

Diseased locusts were first noted in Natal and the Transvaal in the year 1895. The Natal specimens were examined by Mr. Medley Wood and found to be infected with a fungus belonging to the *Entomophthoreae*. Specimens were also sent to the British Museum, and Mr. Medley Wood's determination confirmed. The following year outbreaks of locust disease were again observed in Natal and several parts of Cape Colony. The accounts of the disease from both Colonies agree in the fact that the dying insects always betook themselves to the tops of grasses and other herbage where they remained clinging to their posts long after death.

The discovery of the Natal fungus in this case was made by Mr. Arnold Cooper, to whom diseased specimens had been sent and it was from this material that the cultivation of the locust fungus was attempted, although in this instance it would appear that no steps were taken to get the fungus identified by any authority on the subject. The observers in these cases seemed to be ignorant of the fact that a disease had been recorded the previous year, and that the systematic position of the fungus had been determined. Attempts at its cultivation were made by Doctors Edington and Black at the Grahamstown Bacteriological Institute. It is unfortunate that neither of there investigators has given a detailed description of the fungus actually found on the locusts, their attention for the most part

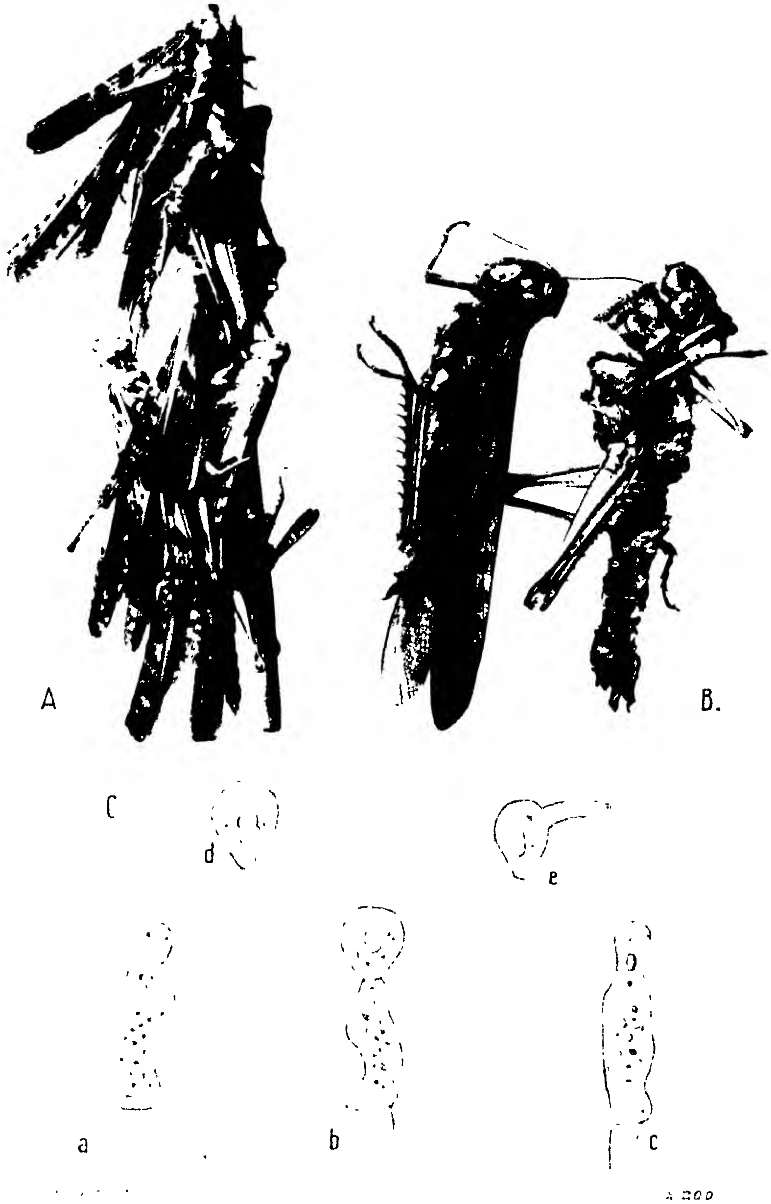


Plate CCXVI.

The South African Locust Fungus.

A. Dead locusts attached to Mealie haulm and killed by *Empusa Grylli.*

B. Locusts showing external appearance of fungus, *Empusa Grylli.*

C. Microscopic appearance of the fungus taken from the buff-coloured growths on the locust—*a, b* and *c*, Hyphæ; at the tip of *b* is an ovoid spore, just ready to be projected off; *d* and *e* are mature spores, *e* just beginning to germinate.

(Photographs by C. W. Howard; drawings by I. B. Pole Evans.)

being devoted to descriptions of the fungus which they succeeded in cultivating on various artificial media. But from Black's description of the fungus on the locusts, both from Natal and the Cape Colony, there is not the slightest doubt that *Empusa Grylli* was the active agent, for he says: "In March, 1896, I had an opportunity of examining some locusts brought from Richmond in Natal, by Mr. Arnold Cooper to the Bacteriological Institute, Grahamstown, where I was at that time medical officer. These locusts Mr. Cooper found dying and dead in great numbers in a maize-field, many of them attached to the maize stalks in a dying condition.

On the dead locusts the fungus appeared as a grey or buff-coloured fur, in patches about the depression between the thorax and the abdomen, and the joint between the legs and body, and the line of the tracheal stigmata of the abdomen. The growth had a velvety appearance and was in all cases very short. On dissecting and teasing out the connective tissue beneath the integument and examining this microscopically, the mycelium of the fungus and round or ovoid conidia were abundantly seen. I found precisely the same appearance in other diseased locusts which were sent to us for investigation from King Williamstown in May, 1896, thus showing that the fungus was spread over a large area of South Africa."

Thus, I think it will be clear that both Black's description of the symptoms exhibited by afflicted locusts, and the external appearance of the fungus, exactly coincides with those which I have given above as being typical of *Empusa Grylli*.

However, Black and Edington attempted to get pure cultures of this fungus. It is true that they succeeded in growing a fungus on a very large scale, but from their clear descriptions and figures so obtained (and actual material which I have examined), it is certain that cultures of *Empusa Grylli* were not secured.

It is interesting to note that both Black and Edington were at first inclined to believe that the fungus belonged to the class *Entomophthoreae*, under which the genus *Empusa* falls.

In fact, Edington even suggests that it is a species of *Empusa*, while Cooper, who was instrumental in getting the work undertaken at Grahamstown, in his report on the disease amongst locusts in Natal, says: "The locusts were covered with a fungoid growth which resembled Muscardine. The fungus is now determined as belonging to the order *Entomophthoreae* genus *Empusa*; the species is probably a new one. and it is proposed to name it *Acridii*."

In spite of this, we find an entirely different fungus, a *Mucor*, being cultivated and sent out from Grahamstown.

In such a case as this, perhaps the would-be practical man, may now realise that precision in identification at the time by an expert would have been invaluable, for doubtless he would have shown that *Empusa Grylli*, a parasitic fungus, existed on the locusts, while a Mucor, an independent saprophyte, doubtless also present on the *dead* locusts, was being cultivated on artificial media.

The result of this was that a fungus supposed to be the active agent of disease was cultivated and distributed wholesale to agriculturists not only in this country but abroad.

In South Africa, success in some cases was reported with this fungus, while with others absolute failure was pronounced.

When we look into the so-called successes more closely, grave discrepancies are found, and as it was impossible to say that such swarms had not been previously infected through natural agencies too much reliance can not be placed on such reports. For instance, I will mention one such example. Mr. H. H. Wells in a letter to Dr. Edington, says: "Permit me to give you the results of my first experiment with your locust fungus. On seeing a swarm approaching, I procured several tubes of the fungus and following strictly the directions for use, I dipped several and allowed them to fly again amongst the others. I did this for two or three days consecutively, using in all fourteen tubes. The locusts had settled in my orchard and through all my potato and mealie crops. I could scarcely comprehand it, but to my profound astonishment, in a day or two, I found the locusts hanging in clusters all over my farm, dead, millions of them, and my potatoes and a 400 bag-crop of mealies saved. The preparation of your fungus for use is so simple that boys and girls can apply it, and the annihilation of such a formidable pest as the locust is a boon, that, since the time of Pharaoh, has been prayed for.

"You are deserving of the gratitude of the farming community of South Africa for placing this wonderful discovery so easily and inexpensively within their reach, and I state positively that, if energetic measures are taken, on the approach of a swarm, to use this locust fungus, the farmer would have always at hand a weapon of extermination which would save his crops and bring him additional prosperity It is difficult to realise the full extent and great advantages of this discovery, but I trust others who have not used it, will follow my example, and have as good reason to express their appreciation."

This letter speaks for itself for it will be noted that the locusts were said to be hanging in clusters all over the farm. This symptom is typical of *Empusa Grylli*, which we know was not disseminated by human agency, but which I am inclined to believe naturally accompanied the swarm to this spot, and had already infected it before Mr. Wells applied his cultures.

In this respect out of fairness to Dr. Black, I cannot do better than to here quote what he has to say regarding the pathogenicity of the fungus he cultivated.* "But what we know of the pathogenicity of this class of parasites does not encourage me to believe that through this agency destruction of locusts will take place on an extensive scale. When I brought the fact of the ease with which the fungus could be cultivated to Dr. Edington's notice, he suggested that it should be sent out in small tubes of glycerine-agar to districts where locusts were abundant and destructive. Large numbers of such tubes were distributed throughout Cape Colony during the latter half of 1896, and, as will be seen from Dr. Edington's report of the Bacteriological Institute for 1896, very favourable accounts were returned of the pathogenic action of the fungus on swarms of locusts in certain districts. But in spite of this positive evidence I do not think that sufficient data for a positive induction as to the value of the fungus

* "Observations on Growth of Fungus Parasitic on Locusts," Transactions of the South African Philosophical Society. Vol. IX., Part 2, 1896-7.

in destroying locusts in large numbers have been collected; it is doubtful, in my opinion, whether this method of spreading a pathogenic mycosis can compete with the usual methods of destroying locusts *en masse*."

Mr. Lounsbury's (The Cape Government Entomologist) views on this subject are clearly defined and we reproduce them here. In his Annual Report for the year 1900, referring to locusts he says: "The whole question of locusts should be given serious attention by Parliament for the Colony will always be subject to invasions, and the artificial distribution of the disease fungus gives no promise of ever proving adequate as a remedy."

As soon as the cultures of this "South African Locust fungus" fell into the hands of experts abroad, its systematic position and efficacy at once became the subjects of enquiry.

It was then found that the material which had been sent round consisted of pure cultures of one and the same fungus—a species of *Mucor*.

In the United States, where the whole matter of the South African locust fungus was investigated on thorough scientific principles, we find that no evidence was obtained to show that a single locust had been killed by the "fungus:" and that the experiments carried out with "the fungus" at the Colorado Experiment Station proved an utter failure, and examination of localities where success was reported, showed conclusively that they were dying from another fungus, *Empusa Grylli*, which had not been disseminated by the hand of man.

In India, also, definite experiments were carried out on locusts with the South African locust fungus by Mr. Stewart Stockman, formerly Principal Veterinary Surgeon to this Department, and as will be seen from his report no evidence was obtained to show that it was of the slightest use.

* "In the first instance my instructions were to try the effects on grasshoppers of the so called 'locust fungus' which is reported to be capable of destroying millions of locusts in South Africa. I received from the Imperial Bacteriological Laboratory two cultures of this fungus, and from these I made several sub-cultures on agar.

"This fungus, which is a 'Mucor,' was discovered during the rainy season on dead locusts in Natal by Mr. Cooper who is a member of the legal profession.

"The available literature on the subject is meagre and unsatisfactory. I have received the 'Report of the Director of the Colonial Bacteriological Institute, Cape of Good Hope' (1898), through the courtesy of Mr. Hedley. I have carefully studied this 'Report,' but owing to the absence of experimental details and the small amount of information given regarding trials in the field, it would have been quite unwarrantable to scatter this fungus broadcast without previously obtaining experimental proof of its efficacy . . .

"I need only here say that in no case where I was careful to use only those grasshoppers which had proved themselves capable of thriving in captivity did I obtain the least evidence that the fungus had any fatal effect. The observations lasted from a week to ten days in each case: insects in all stages of development were employed: and I had seen them

* "The Agricultural Ledger," 1903, No. 3, Calcutta, India.

eat the mixture as well as crawl through it. I might also add that in each case cover glass preparations were made from the mixture by placing the smallest drop on the glasses, and that in every one of these the microscope revealed the fungus. The insects, then, must have swallowed the fungus in considerable quantity."

Summary and Conclusion.

Epidemics of locust disease occur naturally under suitable conditions in various parts of South Africa. All the evidence goes to show that these epidemics are due to a parasitic fungus (*Empusa Grylli*). The attempts to artificially cultivate this fungus have failed, and have unfortunately resulted in the cultivation and distribution of a saprophytic growth which can in no way be connected with the death of the locusts, but which may be found on their bodies after death. So-called successes with this "locust fungus" have undoubtedly been due to previous and natural infection with the parasitic fungus.

The present article purports to be nothing more than a bare statement of facts, which I have gathered together in my investigation of the matter. I have no intention of concealing the fact that I am of opinion that the whole question of the value of the "South African locust fungus" has been greatly overestimated, and has resulted in nothing more than a fiasco.

All the data which I have to hand lead me to conclude that *Empusa Grylli* is the main cause of the mortality that occurs from time to time in South Africa amongst locusts, when a fungous agent is at work. This fungus is entirely dependent for its growth on the living tissues of its host, therefore I fail to see how it can be put to any economic use.

Nature controls the locust pest to a certain extent through the agency of this parasite, but this is not sufficient. Man must resort to some other means than that of leaving it to nature for so far little success has attended his efforts to simulate nature's methods.

In conclusion I should like to express my indebtedness and thanks to my colleague Mr. C. W. Howard, Acting Entomologist to this Department, for the hearty co-operation and assistance which he has rendered me throughout in this matter.

fungus

Since the above article was written, through the courtesy of Mr. Fuller, the Natal Entomologist, we have received two tubes of the so-called locust

The fungus on examination exactly corresponds with the Mucor described by Mr. Massee, from material sent to Kew in January, 1900, by the Department of Agriculture, Cape of Good Hope, and is perfectly free from *Empusa*.

Explanation of Plate CCXXV.

(*a*) Dead locusts attached to mealie haulm and killed by *Empusa Grylli*.

(*b*) Locusts showing external appearance of fungus, *Empusa Grylli*.

(*c*) Microscopic appearance of the fungus taken from the buff coloured growths on the locust.

a, *b*, and *c*.—Hyphae, at the tip of *c*, is an ovoid spore, just ready to be projected off.

d and *e*.—Mature spores; *e*, just beginning to germinate.

THE SPREAD OF INJURIOUS WEEDS.

By H. Godfry Mundy, P.A.S.I.,
Assistant for Seed and Plant Experiment.

One not infrequently hears the remark made by sorely oppressed farmers that every month in the year brings to life in the Transvaal a new disease to stock, a new insect pest or a new noxious weed; however, this may be with reference to the two former trials, it is certain that the spread of dangerous weeds is on the increase and is a matter which deserves no little careful thought amongst the agricultural community of South Africa.

With a view to emphasizing this fact, I propose to give a short account of the appearance and spread of some of these weeds of more recent introduction. In dealing with a subject such as this, it is impossible to avoid going over old ground in the case of some of the better known weeds, but if this tends to draw greater attention towards them it will be a point well gained.

Burr-weed (*Xanthium spinosum*).—One cannot speak of pernicious weeds without devoting a few words to this plant which has now become a universal weed throughout the Transvaal. Although the efforts made to stamp out Burr-weed have in many cases been crowned with great success there yet remains much to be done, and it is remarkable how frequently during a day's trek through the country one encounters isolated patches of this weed, one which I have heard said takes from 5 to 7 years to eradicate from any land it has taken possession of. In spite of the excellent work done by painstaking municipalities and conscientious individuals, Burr-weed still continues to keep a firm grip on the country, and it is only by a more rigorous observance of the Burr-weed Act that this danger can be stamped out.

Numerous farmers devote their best efforts to eradicating it and at the time of writing I have in mind one farmer who destroyed three successive crops of Burr-weed last summer; unfortunately the same cannot be said of all farmers. There are many who either from lack of energy or other reasons absolutely neglect to take any precautions against the spread of such weeds. It is impracticable for the local authorities to hunt out and bring to the notice of an occupier the presence of such weeds on his land as in many instances the plants now occur in places rarely passed by persons going to and fro between the farms.

Not until each individual farmer realises the duty that he owes to his own farm and to his fellow farmers can we ever hope to successfully fight against these pests.

Khaki-weed or Amaranthus weed (*Alternanthera echinata*). Plate CLXXXVIII. Journal No. 19, April, 1907. This little plant is perhaps

not so well known to many farmers as it deserves to be on account of the dangerous manner in which it is rapidly spreading in a northerly and easterly direction across the country.

At present we have no plant closely resembling Khaki-weed and it can therefore be readily identified. In habit of growth it is a creeping plant rarely growing more than 2—3 inches high, but one root may cover as much as a foot square of ground and owing to the thick mass of leaf and stem which it forms, it effectually prevents any other plant forcing its way through.

The small burrs which may occur either singly or in clusters and which add to the dangerous character of this weed, are situated in the axils of the stem and leaves; when they first form they are quite soft, but later on as the plant matures they become sharp and hard and eventually when fully ripe break off and attach themselves to any thing which touches them. The plant sends out adventitious roots from the joints on the stem, in the same way in which ivy grows, and therefore, when attempting to destroy this weed it is not a matter of simply digging up one root, but probably a dozen or more small rootlets, any particles of which left in he ground are liable to take root and grow with fresh vigour.

Originally, this plant was known only in Mafeking, Kimberley and Vryburg where by some people it was said to have been introduced in Australian-baled forage during the war. On the other hand, competent authorities state that they have known of it in Mafeking for the last 30 years; however, this may be, it is certain that Khaki-weed is now spreading rapidly. A year ago, Pretoria was the most northerly point which it had reached; this year I have found it in considerable abundance along the Pretoria to Pietersburg railway, especially at Warmbaths and Naboomspruit, while from Fourteen Streams up as far as Klerksdorp it is to be found at almost every halt and has penetrated in several instances to farms lying as far back as 10 and 14 miles from the line.

The spread of this weed is probably due to the fact that the burrs stick in the wool of sheep and in the tails of cattle and also become wedged in the feet of cattle and goats. It is usually first noticeable along trek roads and on the outspan grounds, this area for instance at Christiana is thickly covered with Khaki-weed, although I do not know of it having yet appeared on other parts of the Townlands

As a proof of the rapid manner in which the plant spreads, where one root was noticed in Pretoria in the summer of 1906, there is now a large patch extending over an area of many feet.

By some people it is maintained that Khaki-weed is eaten by stock, but we have never seen this done to any great extent, and it is certain that in its riper stages no grazing animal, except possibly an ostrich would touch it. In any case its value as a fodder plant can hardly be very great as it appears to turn brown and become hard almost as soon as the ordinary veld grasses.

In Vryburg it is rapidly replacing the grass at the road sides and on the paths, and although there are often animals grazing here they do not appear in any way to lessen its spread.

Plate CCXXVI

(*Leucas martinicensis*)

A weed widely spread over the High and Middle Veld.

Unless this weed is resolutely tackled in its early stages by farmers and others holding land infected by it we shall probably in a few years' time find ourselves faced by another weed which it is necessary to proclaim as noxious.

Bachelor's Button (*Gomphrena globosa*), Plate CLXXXIX., Journal No. 19, April, 1907. Has been on several occasions mistaken for Khaki-weed, but it is easily distinguishable from the fact that the burrs are much larger, softer, and occur always singly and at the terminal point of the stem ; the whole plant is larger and does not grow in so thick a mass. The stems are not so decumbent, and in colour are often of a reddish tint while the burrs in sunlight look almost white.

The plant appears to prefer somewhat dry, barren soil and is generally to be found on stony land and on paths. During the last summer it was very abundant in Pretoria, and some anxiety has been expressed as to whether it is destructive to the grazing or not. With a view to ascertaining this, feeding trials with it were carried out at the Pretoria Botanical Experiment Station, in which it was found that horses, mules and oxen preferred it to the ordinary dry veld hay. However, this may be, animals grazing on the Townlands do not appear to eat it in preference to the native grass while both are green, and we are therefore of the opinion that it will become, if allowed to spread, detrimental, if not injurious, to grazing.

Gomphrena globosa is not confined to the Pretoria District. It is found occurring more or less frequently around nearly all the high veld towns which I have visited. It appears to be a plant which seeds profusely, as it was not noticeable in Pretoria to any great extent during the summer of 1905.

This plant cannot at present be said to be dangerous, but it is one which requires watching and we shall be glad to receive reports upon its appearance, together with any ideas or opinions which farmers may have formed with regard to it.

Leucas martinicensis, Plate CCXXVI., is a plant which, so far as I am aware, has no local vernacular name and indeed up to the present there has been no reason why it should be of much interest to farmers. In appearance it is a lank-growing, somewhat bushy plant, varying in height from 1-2 feet or even more ; the stems are four-sided and flattened. The flowers, which are white and very small, are arranged in dense clusters at intervals around the stem ; the petals of the flowers soon die leaving the dry calices which give the cluster the appearance of a burr. When dry these burrs become quite sharp and hard. The whole plant is a rather silverish-green in colour.

It is widely spread throughout the Transvaal appearing more or less frequently in almost all the high and middle veld districts Around Ermelo and Pretoria it is fairly abundant, while in the neighbourhood of Standerton, Lichtenburg and the Rand it is widely scattered over the veld. At present we only know of one case in which this plant is causing trouble and that is on a farm in the Christiana District, where it is growing abundantly and is spreading both on the veld and in the lands. Owing to the burrs being hard and sharp, it is probable that cattle would avoid grazing on land carrying much of this plant.

We are also informed that it was a source of much trouble in the lands from which it was with difficulty eradicated by dint of repeated cultivations.

It would appear, therefore, that this also is a weed which should be watched by farmers and graziers in order that, if likely to prove dangerous, prompt measures should be taken to destroy it.

The Mexican Poppy (*Argemone mexicana*), Plate CCXXVII, is another weed which has lately made its appearance and which seems to be on the increase; it is probably almost unknown to farmers.

In appearance it is much like a thistle, having the sharp pointed leaves common to this family. It grows to a height of from 1 to 2 feet, and in colour is a dark bluish-green, while the leaves are streaked lengthways down the midrib with a silvery white shading. The flower somewhat resembles that of a poppy and is a pale canary yellow in colour, and after the petals fade a head closely resembling that of a poppy forms, but with the difference that while a poppy head is smooth, this is more elongated and is covered with strong and very sharp thorns; the leaves when mature are also very prickly.

At present we only know of its occurring in any quantity in the neighbourhood of Pretoria and Christiana; it is occasionally met with, however, in most districts and appears to be slowly on the increase.

In certain parts of America it has proved a great pest, overrunning large tracts of fertile land and rendering them practically worthless either for grazing or arable land.

We see that this plant has recently been proclaimed a noxious weed in Cape Colony under the Burr Weed Act.

Datura stramonium, Plate CCXXVIII.—This is now well-known to all farmers under the local name of "Stinkblaar" and is rapidly spreading. It is a tall bush-like plant with long lobed leaves, red stems and a purple or white flower and gives off a very unpleasant odour when crushed or bruised, hence the local name. In itself it is not a particularly harmful weed, but it is worthless as a forage and tends to crowd out better and more valuable plants.

Farmers should take particular pains to rid their land of this weed, as it seeds very profusely and is likely in time to take possession of acres of land.

The spiny burrs become rather sharp and when the plants are growing thickly together cattle are very averse to going in to them. The only effectual way of dealing with this weed is to collect and burn it when still in the half-ripe stage.

If the plants are left to mature before pulling, the burrs burst open and shed seed in enormous quantities, and when in this stage it is impossible to pull up the plant without scattering the seed broadcast over the land.

Although not at present a weed of much danger, *Datura stramonium* is so widely spread over the country and appears to thrive so luxuriantly in the Transvaal that by neglecting to destroy it in its infancy, we may well be laying ourselves open to serious trouble in the future.

Plate CCXXVII.

The Mexican Poppy.

(*Argemone mexicana.*)

Recently proclaimed a noxious weed by the Cape Government.

Plate CCXXVIII

The Stinkblaar.

(*Datura stramonium.*)

A worthless plant now common throughout the Transvaal.

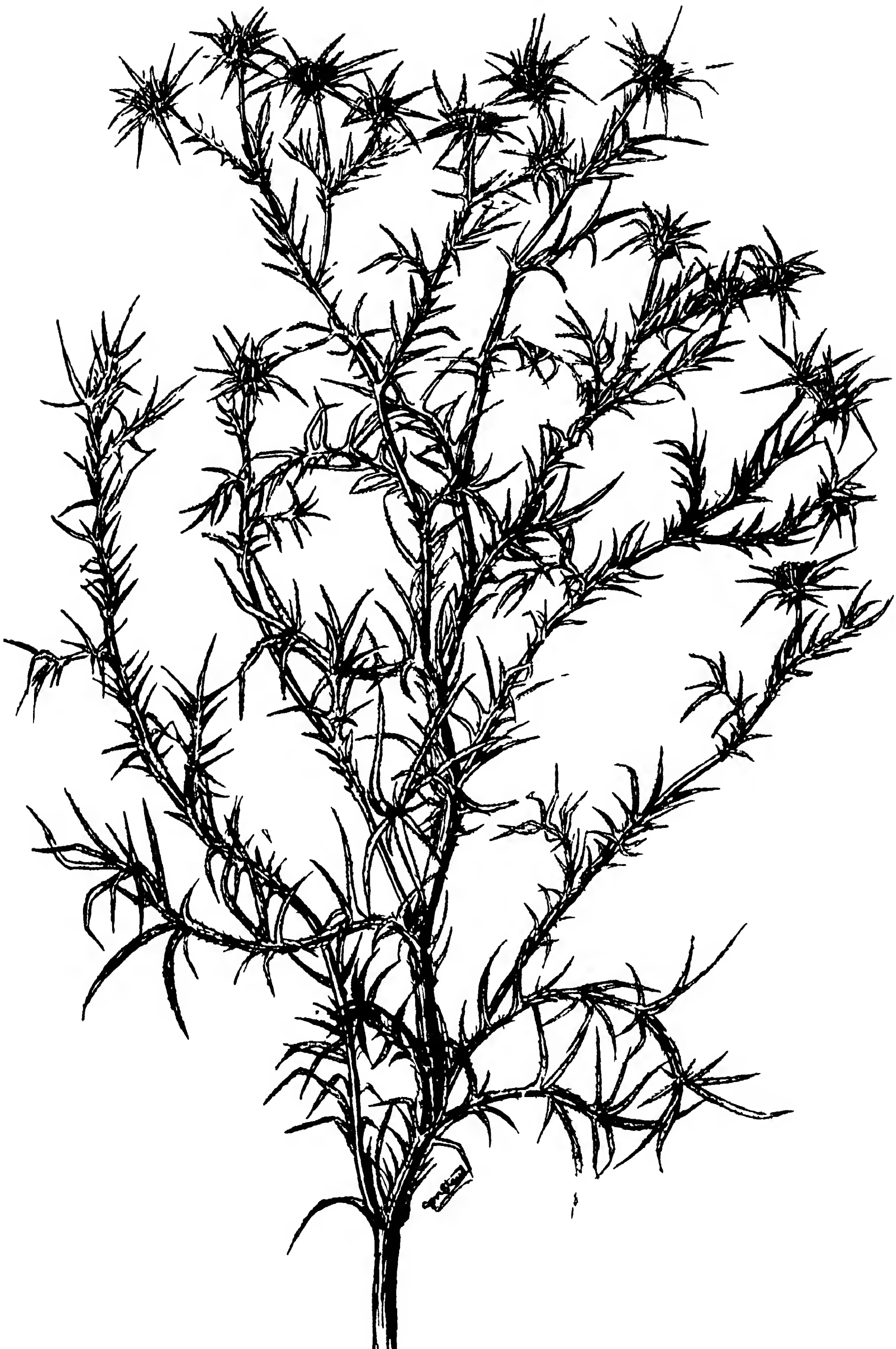


Plate CCXXIX

A Spiny Weed.

(*Berkheya ingrata* Bolus)

Injurious to grazing, prevalent in the District of Standerton

Blepharis sp.—This appears to be an entirely new arrival in the Transvaal.

It belongs to the Acanthus family. The flowers are bright blue in colour and are enclosed in a covering of very sharp prickly bracts; after the petals fall, a burr-like head is left which as it ripens becomes exceedingly hard and thorny; inside this head are the seeds, usually numbering about six and much like a coffee bean but slightly smaller. The leaves are long and narrow and pale green in colour. The plant is quite spineless except for the heads, but as it makes a bushy growth and flowers abundantly a dense wall of prickles is produced. In height it varies from 1 to 2 feet.

It is in Nylstroom where this plant has appeared and already it has taken possession of a considerable portion of the Townlands; growing very close together the plants have effectually destroyed all grass underneath them, and as far as one is able to judge stock of all descriptions would refuse to graze among it. Steps are being taken to destroy the plants in this locality and we shall be glad to hear from anyone who knows of its occurrence in other parts of the Transvaal. Its origin is clouded in some mystery, but since during the war large stores of imported forage were collected at Nylstroom, it seems not unlikely that this may account for its introduction there.

Berkheya ingrata, Bolus, Plate CCXXIX., Compositeæ family, is another species which at first sight seems to be identical with the Blepharis, but a closer examination will show that it much more resembles a thistle.

We are indebted to Dr. Bolus for naming this plant, which appears to be a new species.

The flowers are bright yellow and in shape much like those of a small thistle; the whole plant is exceedingly prickly, both leaves and stems producing strong spines

So far we only know of its occurrence in the Standerton District; it is much in evidence on the Townlands there and is spreading towards the Government Stud Farm on which it has already established itself. Between Standerton and Kromdraai it is to be found in great abundance in the vicinity of the railway line: it then again make its appearance at Paardekop where it is widely scattered over the veld.

At present the plants usually occur singly or in small patches and therefore are not as yet very dangerous, but if they tend to spread and cover the ground thickly they will doubtless do much injury to grazing.

Here again, we shall welcome any further information with regard to this plant as both this and the Blepharis are likely to become a real menace if allowed to spread.

Black Jack, Beggar tick (*Bidens pilosa*).—This is a well-known weed throughout the Transvaal, and owing to the heavy rains of last year appears to be on the increase. There does not, however, seem to be much need for apprehension with regard to this plant as both in its green state and when dry it is much relished by stock.

The "ticks," though causing considerable inconvenience both to stock and human beings, are not apparently injurious to wool as with the advent of the first rains they usually decay and drop out of the fleeces.

It is therefore a moot point whether Black Jack is not more useful than otherwise.

Finally, a few words may be said about the desirability of proscribing injurious plants under the Noxious Weeds Ordinance.

There is no truer saying than that "familiarity breeds contempt," and when one considers the lax way in which the present Burr-weed law is often observed, one hesitates to think of the state of affairs were there half a dozen other weeds included under a like Ordinance.

Proscription of weeds should only be looked upon as a last resource when other remedies fail, and if farmers and persons responsible for land in the Transvaal will only realise that as members of a community they owe it to themselves and to their neighbours to keep in check the spread of plants detrimental to the value of the land on which they grow, there should be no occasion for further noxious weed ordinances to be drawn up.

* * * *

NEW ZEALAND FLAX.

Phormium tenax, Forst.

Mr. G. de S. Baylis, formerly of this Division, and who has recently been collecting grass and other useful seed for us in New Zealand, in a letter to Mr. Burtt-Davy, makes an interesting statement regarding New Zealand Flax, which we reproduce here.

"Of late years this has become quite one of the leading industries of New Zealand. So much so in fact that the Government have appointed special officers to grade the flax exported, and experts in the growing and preparation of the fibre so as to foster and improve the industry.

"New Zealand flax exists in many varieties—some practically useless for fibre, other producing most valuable material.

"It can be found growing in the flax swamps, on the slopes of the hills and even clinging to the sides of precipitous rocks, having rooted into some crevice or opening. It grows from about one foot to many feet high, in many soils, varying degrees of moisture, many altitudes and many climates. As fibre producers there are some varieties which are well worth growing; there are others absolutely useless, and therefore in introducing the plant into a new country it is well to start with good material. There appears to be difficulty in getting it to come true from seed under the present conditions and the best way for the present is by root sub-division.

"There is a lot of money to be made from flax growing, and as a cultivated crop a very large amount should be obtained. It has up to the present in New Zealand only been grown by nature, and the native swamps, as they are called, cut for the fibre; but the Government is seriously contemplating planting out large areas of it, and growing it as a cultivated crop.

"Seeing the difficulty of running stock in some of the lower and middle veld it would appear that where the country and soil is suitable that flax growing might form a useful industry. Once established it is not easy to kill it, and along vleis and such like places slightly damp it should do well. Whether or no Transvaal grown flax will produce a good fibre remains

to be proved, but since there are so many varieties, some good, some bad, and since various soils and climates have their own special favourite more or less, that question can only be proved by obtaining *good fibre* varieties for test.

"Roughly speaking perhaps 2,000 acres of cultivated flax would keep a mill going, and the machinery required is, I believe, not so very expensive. There are only about two places in New Zealand, I believe, that so far a collection has been made for testing the different varieties of fibre. I am informed that roots could be sent if properly packed even as far as the Transvaal, in much the same way as fern roots are sent, and I believe you might get 10 or 12 good fibre selected varieties for about 20s. per root, that is to say, if they can be spared.

"I thought I would let you know, as it seemed to me it might be a crop worth trying in some parts of the Transvaal, and it has the advantage of being an industry also.

"To run a mill it is not necessary to have all the flax growing immediately around. It can readily be carted, and I have seen it here sent down in trucks by the train to a mill. A patch of flax, therefore, may be grown on any suitable soil where the area is large enough to warrant the cost of fencing to keep stock off of it. I understand that the necessary machinery for a smal' mill is not very costly, perhaps a matter of £100.

"Even should the Transvaal prove unsuitable for growing flax of sufficient quality of fibre for export purposes or for the manufacture of ropes, if it could produce a fibre of any strength at all, patches of it grown around the homestead would prove invaluable for many purposes for which ropes and twine are used, and one often sees here a few strips of flax leaf knotted together, thus forming an impromptu rope. I suggest the strong fibre varieties as well worth a trial in the Transvaal.'

The following notes on the cultivation of New Zealand Flax by Mr. Burtt-Davy will prove of interest to our readers :—

1. *Preparation of the Soil.*—It must always be remembered that New Zealand Flax, although generally to be found in swampy, undrained, sour lands, does not grow in such localities for preference, but rather because in more favourable situations the struggle for existence has been so keen that it has been forced to take refuge in really unsuitable positions where the struggle is considerably slighter. This explains the reason why New Zealand Flax is often found in such apparently contradictory situations as sand dunes and swamps.

The best soil for the cultivation of this plant is rich well drained swamp land, but as this is generally reserved for the production of cereal crops, the hemp grower naturally turns his attention to the improvement of the already existing flax swamps, which at present are quite valueless for farming purposes

The first thing to do, and one of prime importance, is to drain the swamp as carefully as possible by means of deep main drains and smaller cross ones which will carry off surface water. The increased length of the leaves of the existing flax will very soon be evident, due to the improved

sanitation of the swamp. All parts of the swamp, where practicable, should be ploughed as deeply as possible, and these ploughed areas can then be planted.

2. *Planting.*—There are two methods of securing plants. The first is by dividing up the fans of wild plants, taking care to select those which appear to possess the largest amount of fibre, and secondly by seed. This second method is very good, but it takes a considerable time for the seedlings to become large enough to plant out. One of the advantages of using seedlings is that if the seed has been carefully selected from suitable plants, there will be far more uniformity amongst the seedlings than amongst the wild plants. The seed should be sown in specially prepared seed beds just as you would sow cabbage seed, and when the plants have attained a certain size they should be pricked off into rows, one foot apart, and remain there until they were large enough to be permanently planted out. Only the strongest and most fibrous of the seedlings should be used. In planting, if the ground has not been carefully ploughed, it should be well worked where each plant is to be put. There are two methods of planting, the first—the Maori method—is to sort out four "fans" at right angles to each other, the ends of the roots together, the tops inclining outwards—the plants will then have a slanting position. The other way is to plant them in single rows at a distance of about six feet from each other in all directions. I am strongly in favour of the latter method of planting, as it makes the ground much more easy to work than if planted in the Maori fashion. The number of plants required for planting an acre will be nearly 5,000. If the plants used are wild ones it will be necessary to cut off the leaves on a level from a few inches above the roots upwards, as the outside leaves of wild transplanted "fans" generally die and retard the growth of the new shoots. With the prepared seedlings this mode of procedure will be unnecessary, as they will continue to grow when planted out without receiving any check.

3. *Varieties.*—There are a great number of varieties which have special Maori names, but these are not reliable, as the same variety goes by different names in different districts. The artificial selection of plants by means of seed will in the end give the most satisfactory results in producing improved varieties, though it takes longer to get a return. Plants which yield a large amount of fine long fibre should be marked, and the seed saved. Any of the seedlings which show marked superiorities over the rest should again be marked and their seed shown; and in this way, in three or four generations of flax, the improvement in the quality of the fibre will amply repay any trouble that has been taken.

4. *Yield.*—The average yield of uncultivated flax is from twelve to eighteen tons to the acre. From an acre of cultivated flax on good soil probably over fifty tons of raw material should be cut, judging by the small experiments which have been made. The yield in fibre is likewise much higher in cultivated than in uncultivated flax.

From the above it will be seen that with proper care the cultivation of New Zealand flax should become a very profitable occupation.

THE ENTOMOLOGICAL SECTION.

No. I.]

LOCUST DESTRUCTION DURING THE SEASON, 1906–1907.

By C. W. Howard, B.A., Acting Entomologist.

The locust problem in the Transvaal assumed enormous proportions during the past year. Never in a generation before has the infestation been so large, and had it not been for the organised work carried on against this pest, it is safe to say that very few crops would have survived the ravages of the voetgangers.

In many respects the actions of the locusts were peculiar. The invasion from the Kalahari came nearly three months earlier than had been the case during our brief experience with locusts in the Transvaal. The unusually early and heavy rains also caused the eggs to hatch much earlier than in previous years.

For the sake of clearness, I shall treat the work against the brown locust voetgangers separately from that against the red locust voetgangers. The former is usually drawing to a close in the Western Transvaal at about the time that the latter is beginning in the Eastern Transvaal.

The Brown Locust.

In the middle of March, 1906, a few swarms of locusts crossed the Transvaal border at the south-east corner, and a little higher up, at Kunana's location. These took a general north-easterly direction, and, although circling about considerably, reached as far east as Potchefstroom, and as far north as Zeerust. During April more swarms invaded the Colony, and passed as far north as the upper part of the Zoutpansberg District, and as far east as the middle of the Lydenburg District. Farmers were not prepared for such an early invasion, and the destruction of late crops by these flying locusts was very large. All late mealies, as well as Kaffir corn, and nearly all the late garden crops, such as potatoes, beans, etc., were wiped off over the region they covered. In addition to this, the damage to the veld was very great. All the tender, green grass, which would have served as food for the stock during the winter was devoured. This was especially unfortunate, as the previous season had been very dry and a long dry winter was to follow. Considering the large portion of the Colony covered by these flying locusts, and the time during which they stayed with us, it is impossible for us to estimate the money value of crops

and veld destroyed, but it was certainly enormous, as the swarms were of immense size, many being estimated at between 40 and 60 miles in length. During May the swarms continued to fly about, many passing over our northern boundary into Rhodesia.

Plate CCXX. shows the area of the Colony covered by flying locusts before the egg-laying season. During May and June they seemed to prefer the warmer parts of the Colony, such as the bush veld regions, and by the middle of June egg-laying began, whereas in the previous season eggs were not laid until August. Oviposition continued during July and August, and after that very few swarms were reported flying about. The females died immediately after the completion of oviposition, but a few swarms of males survived for some time, one or two being reported as late as the early part of December. By the end of July we were able to make a forecast of the parts of the Colony which would be infested with voetgangers. This forecast was printed as a leaflet both in English and Dutch, and distributed widely among the farmers. As a result, a great deal of interest was shown in the work. Reports of the hatching of voetgangers came in very freely and promptly and we were able to have material and men in the field at an early date ready to cope with the pest while still very young. During the interval, between July and the first rains, the late Mr. Simpson and the Assistant Chief Locust Officer were also able to visit most of the regions where the eggs had been laid, in order to make arrangements for the carrying out of the campaign.

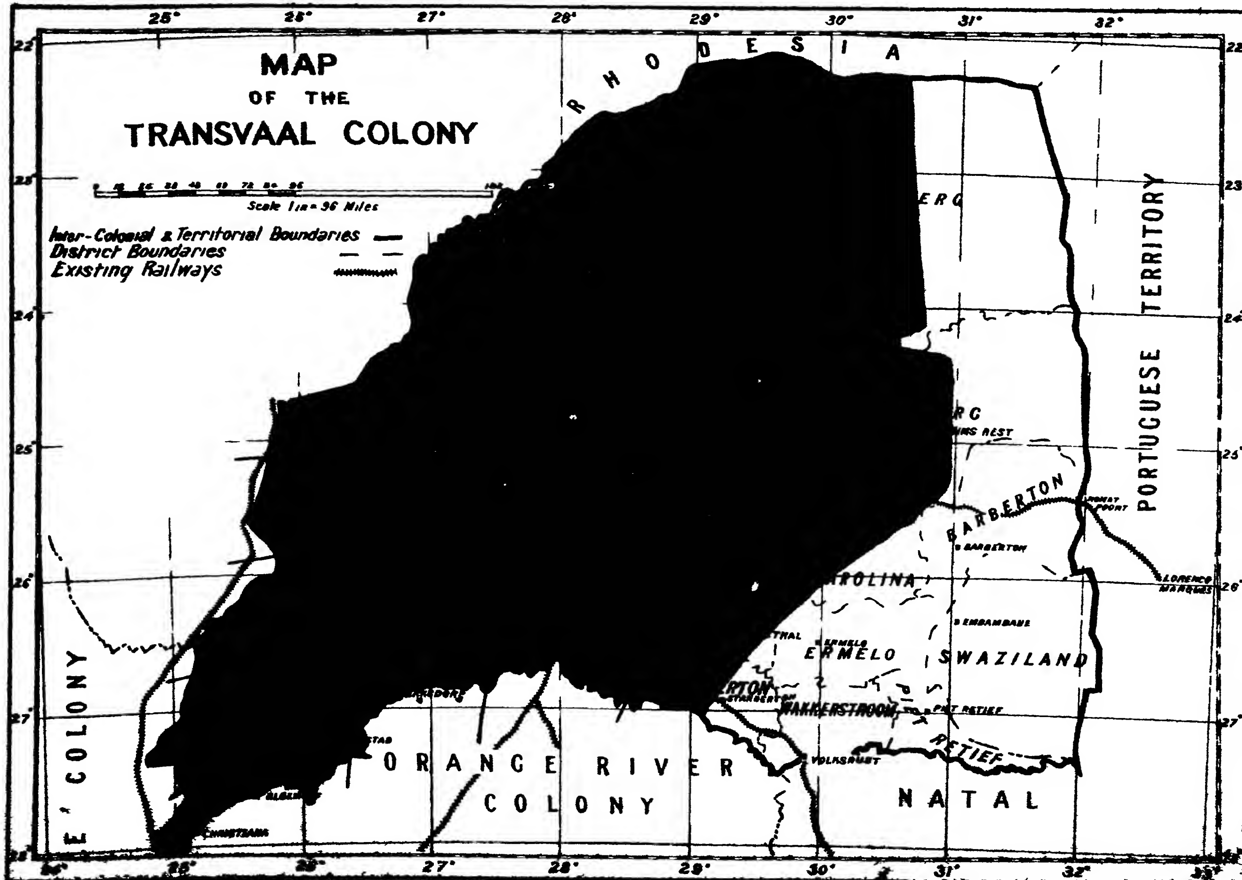
Plate CCXXI. shows the portions of the Transvaal where egg-laying occurred, and where we had to carry on work against the voetgangers when they hatched out. The darker areas indicate where the infestation was heaviest.

Our first rains began in September, but were confined to the northern and eastern portion of the Colony, consequently, voetgangers hatched out first in those parts, not appearing till two or three weeks later, or even more, in the south-western and western districts.

The infestation was exceptionally heavy in the Zoutpansberg, Waterberg, Rustenburg, Marico, northern part of Pretoria, and the western and northern parts of the Lydenburg Districts. In those portions practically every farm was full of brown locust voetgangers. Such wholesale infestation had never been known before. Some few early mealies were destroyed by voetgangers when they first hatched out, but there was still time to replant, so that it could not be considered as a great loss.

The remaining districts where locusts occurred, were not so badly infested as the above-mentioned areas. In each one, however, nearly all the locusts present were destroyed by our officers and the farmers, so that very few swarms were enabled to obtain wings. Those which did succeed in escaping our observation, and acquiring wings, flew at once in a southwesterly direction, and out of the Colony. The reason of this rapid flight was that they were pursued by locust birds.

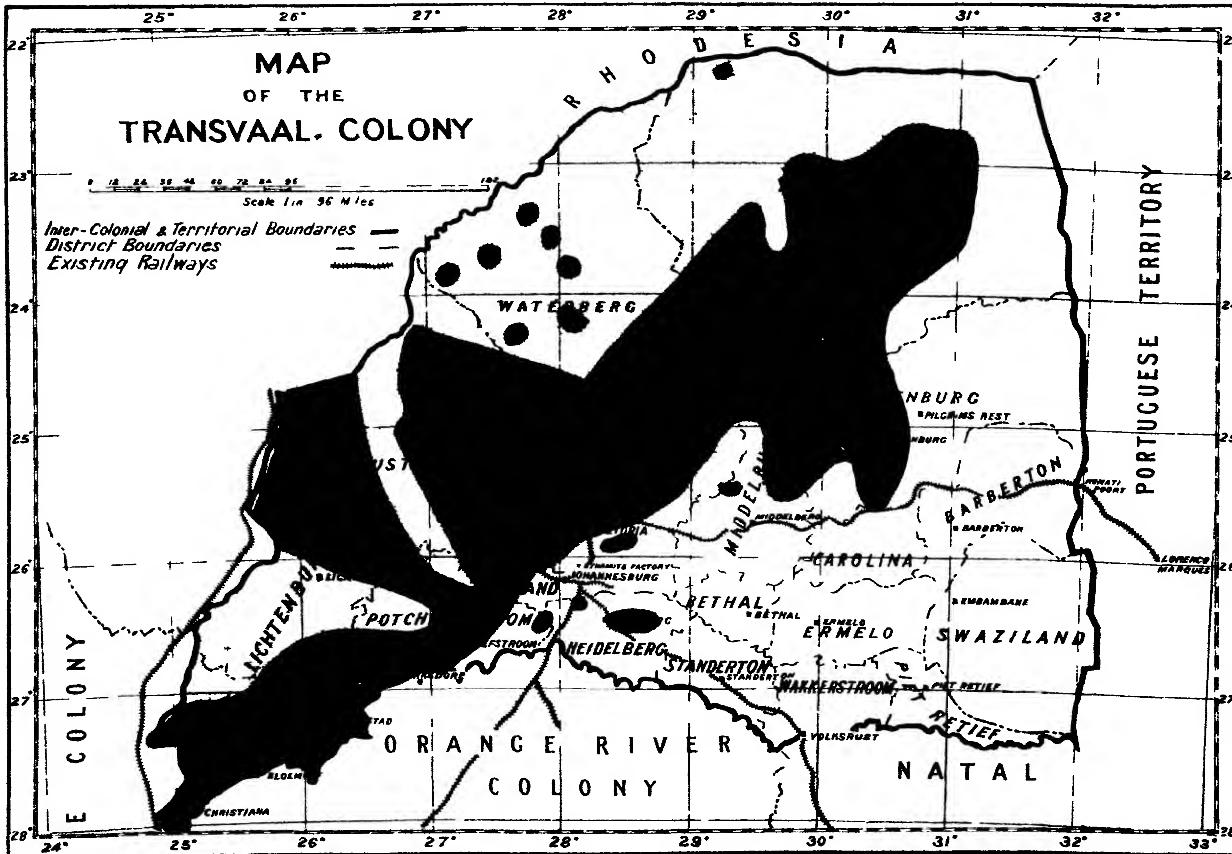
No. I.—Area Covered by Flying Brown Locusts—March to August, 1906.



Arrows indicate the general direction of flight.

No. II.—Area Infested with Brown Voetgangers—October to December, 1906.

Plate CCXXI



Darker areas indicate the heaviest infestation.

The following tabulated form will show at a glance the principal facts of interest concerning the campaign :—

District.		Farms infested.	Swarms destroyed.	Crops saved	Cost of Campaign			No. of men employed.
				£	£	s.	d	
Bloemhof ...	...	63	600		262	6	0	2
Heidelberg ...	...	11	21		216	5	0	1
Lichtenburg	...	90	300		326	18	4	2
Lydenburg ...	...	163	849		1,598	18	0	16
Marico ...	...	126	1,700	60 000	565	18	7	5
Middelburg ...	...	98	357	--	443	9	0	2
Potchefstroom	...	60	1,150	6,950	562	13	0	5
Pretoria ...	..	34	1,500	3,965	979	3	10	10
Rustenburg ...	...	315	1,150	11 000	641	1	1	6
Waterberg ...	...	182	2,000	10 000	1 520	1	4	25
Witwatersrand	...	39	296	325	241	19	10	1
Wolmaransstad	...	79	303		286	8	8	2
Zoutpansberg	...	375	1,911	10 000	1,831	5	8	22
								2 asst chiefs
TOTALS		1 635	12 137		£9 479	11	4	101

The total number of swarms destroyed seems a large estimate, but I do not hesitate in saying that this was probably only one half of the actual number. It is very difficult to ascertain how many swarms were destroyed by farmers, and, in addition, the swarms were of such an enormous size that it was difficult in many cases to find the lines of demarcation between swarms. In many cases swarms of voetgangers moved across the country with a frontage of from five to six miles.

As a matter of interest, we made an attempt to obtain an estimate of the value of the crops saved in the various districts by the destruction of the voetgangers. We found this a very difficult matter. Most of our officers reported : All crops saved. We did, however, obtain a few estimates, but it can be readily seen that these are extremely low, and in most cases should be increased by at least ten to twenty times the original estimate. But by comparing the cost of the campaign in the districts from which we have obtained estimates, with those estimates, conservative though they may be, we find that we have spent between 1 per cent. and 10 per cent. of the value of the crops saved in carrying out the work of destruction. As a fair average, I think I can safely say that we have spent less than 1 per cent. of their value in saving the crops.

The greater part of the money spent on this work has returned to the districts where the work was carried on, as we endeavour to obtain officers in the district in which they are to work. Salaries and transport allowances to locust officers amount to about 65 per cent. of the total expenditure. The remaining 35 per cent. of the cost goes into railway transport, cost of material, P.W.D. transport, etc., much of which finds its way indirectly into the district.

A large amount of the success of the work was due to the excellent men whom we were able to secure for the positions of locust officers. We endeavoured, as far as possible, to secure men familiar with the country and the people, usually speaking not only English and Dutch, but some native dialect, as well as possessing considerable tact. The result has been

that in every district the farmers have taken up with the work enthusiastically, and we have scarcely found a man who refused to destroy his own locusts. Natives have also assisted to a great extent.

Our experience in former campaigns made us decide to continue the use of the arsenical spray for destroying the voetgangers. Consequently, all other methods were abandoned, except such as certain farmers used upon their own iniative, and our whole effort centred upon this one method, There were numbers of cases of poisoning of cattle during the campaign. all of which were entirely avoidable, and in nearly every case were due to gross carelessness. Before the campaign commenced, a leaflet was issued explaining the use of the arsenite of soda spray and the manner of preparing the mixture and pointing out the dangers following its use. This was printed in both English and Dutch, and widely circulated. In addition our officers gave explicit instructions and warnings to the farmers who received the poison for spraying. The formulæ recommended by this office are the result of careful experiment and observation, and if they are followed the danger of poisoning cattle is very slight, but if solutions of arsenite of soda are used of greater strength than those we recommend, we cannot be responsible for the result.

We have been greatly assisted in our work by natural agents. Foremost amongst these are the locust birds. Not only the usual locust birds, but nearly every species of locust and insect eating bird took to the food which was so abundant, and destroyed immense numbers of voetgangers and fliers. In additionto this a parasitic fly (probably *Cynomia pictifasciis*) has been doing a considerable amount of good. A great deal has been written about a similar parasite which has been very plentiful in the Argentine during the past season, but few people seemed to realise that there was one just as abundant in the Transvaal. This fly belongs to a family which is naturally parasitic on other insects. The eggs, or young maggots, are laid by the mother fly on the backs of the voetgangers or adult locusts, beneath the wings or wing-pads. The young larva grows inside the body and destroys the internal organs, eventually leaving only the empty skeleton, and thus destroying the locust. The transformation to the fly takes place in the soil. As the life history is only of short duration, and the female fly lays a hundred or more eggs, they increase very rapidly in numbers, and before the season had closed were reported as very abundant in almost every district. It is difficult to estimate exactly how much we owe to the existence of this parasite, but the number of locusts destroyed was very large. It also spread eastward, and destroyed large numbers of red locusts. The prospects are that it will be yet more abundant this coming season and render us still more assistance. In 1886, a similar parasite appeared, so at least it is stated, and for several years afterward there were very few locusts. Owing to its prevalence this season, it would have been a waste of time to undertake any artificial propagation and dissemination. We cannot depend, however, upon this parasite to wipe out the locust for us. While we were waiting for this to occur there would be very few crops survive the attacks of the voetgangers. We can only consider it as a very valuable natural ally in the good work.

From the 1st January, 1907, to the 1st of March, 1907, the Transvaal was free from brown locusts in all stages, but it is to be regretted that on

the latter date swarms of flying locusts began to invade our Colony from the south and south-west borders. These swarms have now covered nearly the whole of the Transvaal, except the south-east and north-east corners, having reached as far as Barberton, a district which they have not invaded for some years previous to the late war. The damage done by these swarms is much heavier than that which was done in the corresponding invasion of 1906. The past summer being unusually favourable for agricultural pursuits, many farmers were induced to plant late crops all of which were lost. Contrary to their usual custom they have eaten lucerne, potatoes, and even tobacco and orange trees. Kaffir corn was nearly all destroyed, whilst mealies suffered badly only in the south-western districts. Further north the mealies were too ripe and hard for the locusts. The same damage as during the previous season has resulted to the veld in the destruction of all green grass. Many farmers report a total loss of their tobacco and mealie crops, while their orange trees have been ruined for several years. The loss in money value would amount to hundreds of thousands of pounds, in one district alone it is estimated at £219,421.

The question naturally arises as to where these swarms of locusts have come from, which have invaded us each year about this time? They have certainly bred outside our borders, and the Central Locust Bureau, by collecting reports from all parts of South Africa and tabulating them, seems to have solved this question for us.

There seem to be two generations of brown locusts in South Africa. The first generation hatches from eggs which have been laid in that part of the Kalahari Desert, which is included in British Bechuanaland, Gordonia, Griqualand West, Kenhardt and Prieska Districts of the Cape Colony, and including all the central portion of the Cape Colony from the Great Fish River eastward to Middelburg, and almost as far south as Oudtshoorn. The eggs are laid here early in January, hatch at once, and the voetgangers are full grown early in March, when at once they begin to proceed south-east, east and north-east, invading eventually nearly the whole of the eastern Cape Colony, Basutoland, Orange River Colony, Transvaal, most of Southern Rhodesia and parts of the Bechuanaland Protectorate. Here they stay until from June to August, when they lay their eggs which hatch with the first rains of the season, and become winged by December.

This information shows us that our success in combatting the pest depends upon the co-operation of all the South African Colonies and territories. If each Colony will destroy its own voetgangers between October and December, there will be no locusts to go into the Kalahari in January, and no locusts to invade us in March. If, on the other hand, only one or two of the Colonies destroy their voetgangers, there would still be plenty to breed in the Kalahari, and those Colonies who are working have to suffer invasion each year, merely as the result of their neighbours' negligence.

The Red Locust.

During the months of March to July, the red locusts were found to exist in the warm valleys of the eastern low veld, where they flew about here and there in an aimless fashion, often doing considerable damage.

In August there was a small invasion through the Barberton District, but it was not until September that the invasion was at all general. During that month large swarms passed northward, from Natal and Swazieland, eventually covering the Piet Retief, Ermelo, Carolina, Barberton, Lydenburg, and a part of the Middelburg Districts, and most of the Zoutpansberg District. (See Plate CCXXII.) By the middle of November they were laying eggs, which began to hatch by the middle of December. The egg hatching extended over a considerable length of time, owing to the fact that the eggs are laid at a season when rains are general, each lot hatching out very soon after laying, whereas with the brown locust the eggs are deposited in the dry season, and hatch all at the same time, after the first rains.

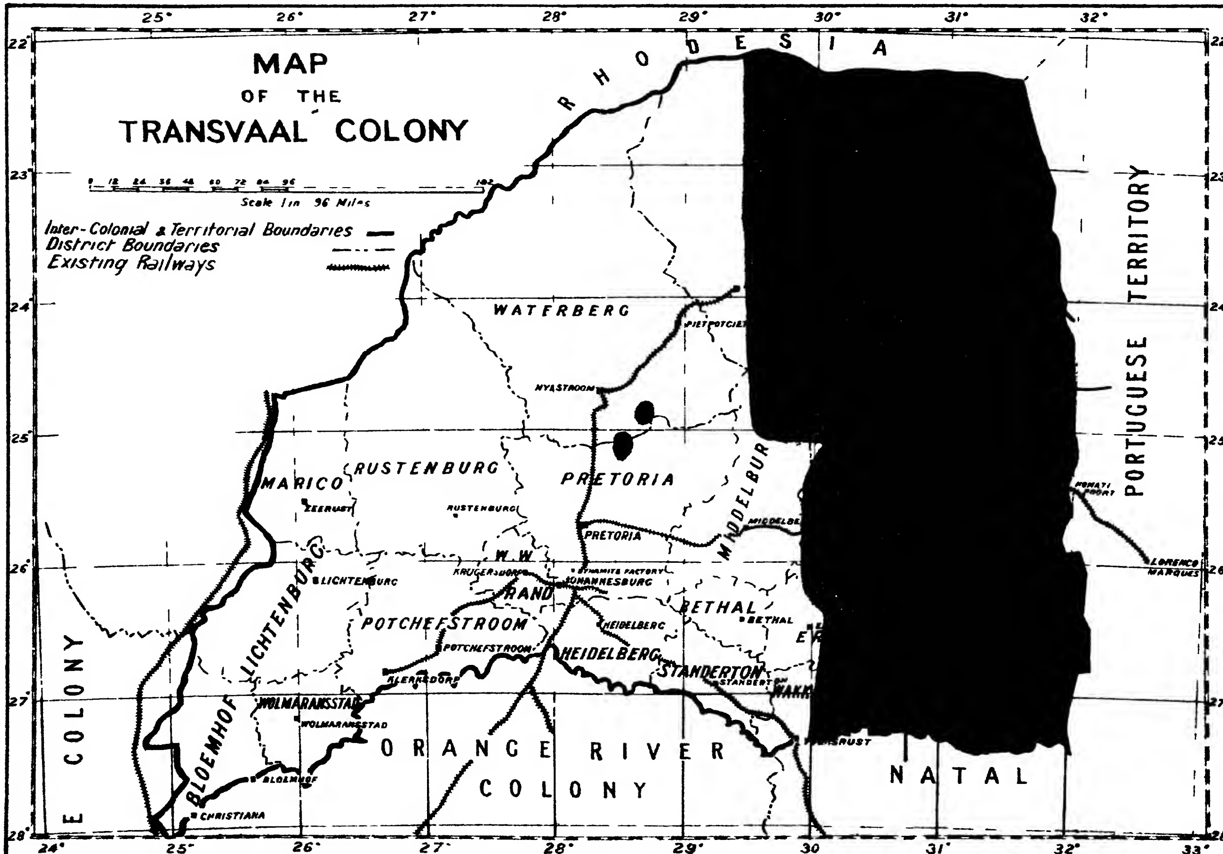
Although the winged locusts covered the whole of the eastern third of the Transvaal, egg-laying occurred only in the Piet Retief, Barberton, Lydenburg and Zoutpansberg Districts, with three small isolated spots, one in the Waterberg, one in the Pretoria, and one in the Carolina District. (See Plate CCXXIII.) It was necessary for us to carry on operations against the red locust before our work with the brown locust was complete. This was comparatively easy, as in the Zoutpansberg and Lydenburg Districts both locusts were present, and the same lot of men were employed throughout the season.

The infestation was especially bad in the Piet Retief District, as well as the Barberton, and our work was seriously handicapped by the heavy rains. The rain made travelling extremely difficult for our officers and also delayed the development of the voetgangers, and washed the spray off the grass, making it necessary to repeat the operation of spraying several times. On several occasions it was impossible for any work to be done for as long as a week at a time, on account of the unfavourable weather. As a result the work lasted over three months, whereas last year it was finished in about two months. Lack of funds towards the middle of the work compelled us to devote our attention solely to those swarms which were endangering crops. We were very successful in saving all the crops, not only of white men but also of natives, but unfortunately many swarms of voetgangers obtained wings and left the Colony. These might have been destroyed had we had the funds for the purpose. The following is a tabulated statement of the work done against the red locust:—

District.	Farms infested.	Swarms destroyed.	Crops saved.	Cost of Campaign.	Number of men employed.
			£		
Barberton	56	5,735	5,430		11
Lydenburg	240	1,593	5,000	--	23
Piet Retief	70	5,700	4,000	-	3
Zoutpansberg ...	670	2,282	6,000		11 1 asst. chief L.O.
TOTALS	1,036	15,310	--	£4,095	52

No. III.—Area Covered by Flying Red Locusts—Season 1906-7.

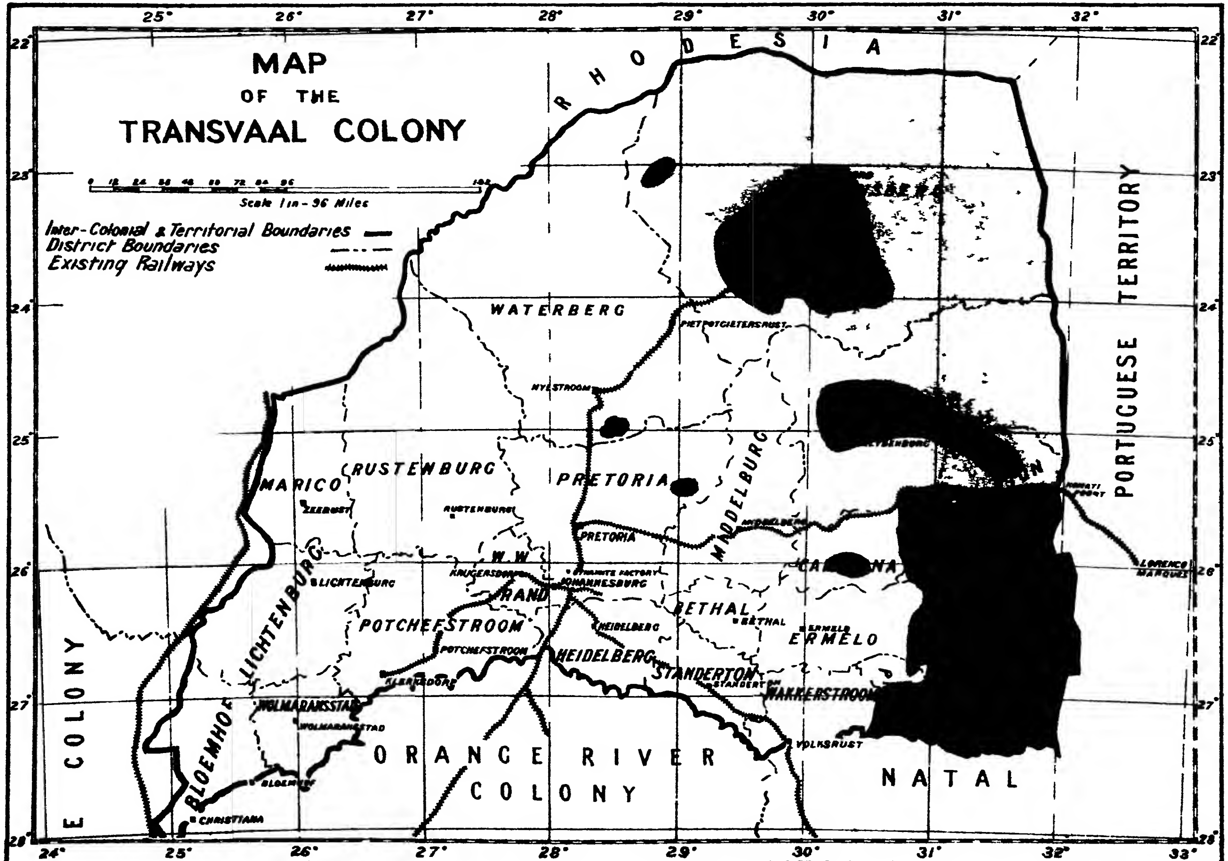
Plate CCXXII.



Arrows show the general direction of flight.

No. IV.—Area Infested with Red Locust Voetgangers—Dec., 1906, to Mar., 1907.

Plate CCXXIII.



Darker areas are where the infestation was heaviest.

The totals look much larger than for the brown voetganger campaign, but this is due to the fact that the red voetgangers swarms are never so large as the others. With the brown locusts several small swarms seem to unite into one large mass, but not so with the red. One swarm of brown voetgangers would equal about four or five of the red.

Practically no poisoning cases occurred during our operations against the red voetgangers. This was probably due to the fact that the spraying was carried on much longer in the eastern districts than elsewhere, and the famers are more familiar with its use.

The same remarks regarding the natural enemies of the brown locust might be repeated here in connection with the red locust. The fly parasite became very abundant and destroyed large quantities of the voetgangers. The famous African locust fungus also appeared amongst the red locusts after they had obtained wings. The conditions seemed just favourable for its growth and dissemination, owing to the large amount of rain that had fallen, and the consequent warm and muggy condition of the atmosphere of the low veld, and it wiped out a large number of swarms in the Barberton District, Piet Retief and Swazieland, whilst on their way to winter quarters along the coast. This again is an enemy of the locust upon which we cannot rely to any great extent. The natural conditions under which it occurs are peculiar. When the right amount of heat and moisture are present in the atmosphere it usually appears spontaneously. Otherwise it is useless to try to propagate the disease artificially. Upon the high veld it is usually too cold and dry for the fungus to survive, so that it is impossible to think of employing it against the brown locust.

No. II.]

HOUSE FUMIGATION AGAINST INSECT PESTS.

By F. Thomsen.

In the April number of the "Agricultural Journal" I described how to fumigate citrus trees against insect pests. We have since had a large number of enquiries asking for remedies against insects in dwelling houses and other buildings. I am, therefore, sure that it will be of interest to many to hear of the ways and means to destroy these pests.

There are several methods of fumigation in common use at present. I shall, however, deal only with one: fumigation with hydrocyanic-acid-gas. The fumigation with sulphur, insect powder, or formaldehyde is well known, and most people who have tried this method have found it to be of little use against insect pests. As a rule, they either do not kill all the insects, or spoil the silver, copper, or brass articles in a house. If the hydrocyanic-acid-gas is used, none of these drawbacks will be encountered. This gas is very poisonous, and soon destroys every living thing. It is also light and quickly fills all corners and crevices, and there is no danger of explosion. Various kinds of insects require different

strengths of gas; thus, if we wish to kill mosquitoes or flies, a small percentage of gas is sufficient, but cockroaches and bed-bugs require a stronger gas, and fowl ticks an extremely strong dose.

How to Use Hydrocyanic Acid-Gas in Fumigating a House.

The following ingredients are used in producing the hydrocyanic-acid-gas, *i.e.*, cyanide of potassium, sulphuric acid, and water. The mode of operation is as described in the orchard fumigation, that is, take a large tin or enamelled dish, put in the necessary amount of water, add the sulphuric acid, and then drop in the cyanide of potassium, which must be pounded rather fine and placed in a paper pag; this allows time enough to withdraw from the room. The strength of the gas is regulated by the size of the room and the kind of insect to be killed. If we take 100 cubic feet of space as a unit, we find that to destroy mosquitoes or flies, ½ ounce cyanide of potassium, ½ fluid ounce sulphuric acid, two to three ounces of water has to be used.

Against coackroaches, bed-bugs, or moths:—

1 ounce cyanide of potassium.
1 ounce sulphuric acid,
4 to 6 ounces of water,

for every 100 cubic feet, and against fowl ticks, more than three times this strength must be used, and is, even then, not always effective

The best time for fumigation is at night, although flies and mosquitoes might be killed during the daytime. Most of the above-mentioned insects become active when it becomes dark, come out of their hiding places, and will therefore be easier killed by the poisonous fumes

Now let us say a room 16 feet by 12 feet and 14 feet high has to be fumigated against bed-bugs In order to find the cubic space, multiply the length by the width and height. 16 x 12 x 14. This gives us 2,688 cubic feet, and this divided by 100 gives 26·88 units, or to round it off 27 units of 100 cubic feet We therefore use 27 ounces cyanide of potassium, 27 ounces sulphuric acid, and at least 108 ounces of water, to fumigate a room of the above size against bed-bugs and cockroaches, to have any success The same strength of gas will also be found serviceable to destroy moths, mites in fowl houses, rats and mice As mentioned before, mosquitoes and flies only require half this strength, and fowl ticks or "Wandluis" (*Argas persicus*), more than three times this strength in order to succumb. The latter are very difficult to kill, and the fumigation should be followed up about ten days later with a good spray of hot paraffine emulsion, to which some crude carbolic acid might be added.

It is not advisable to gasify more than six ounces of cyanide in one dish, four ounces is even better, as it will be found that the compound boils over, or that the cyanide will not all be dissolved and gasified.

In a room of above size, we therefore have to use at least six dishes. Place one of the dishes in each corner, and the other two more or less in the middle of the room, perhaps under a bed or wardrobe, as the case might be. The dishes or tins (empty paraffine tins will do) must be large enough to avoid spilling, and thus spoiling the carpet or floor. Remove all fluid

Plate CCXXII Showing the Fumigation of Fowl-houses against Mites at Warmbaths.

and eatables from the room, as the hydrocyanic-acid-gas combines with water, and makes a highly poisonous compound; even moist walls will retain a small quantity of the gas, and give off a strong smell of bitter almond for several days. Should this happen in a bedroom it is best to ventilate well, and a good way to do this, if there is only one window, is to keep a fire burning to heat the air in the room for a few hours, and then open the doors and windows. Any moisture will soon be dried up, and the cold fresh air will enter the room quicker.

Meal, cereals, clothing, or bedding can remain inside. It is advisable to open all doors of lockers, boxes, or wardrobes, and hang up blankets and sheets. See that all doors, windows, and other openings are well closed; if any of these should not shut tight, paste some paper over the opening; ordinary flour and water paste is good enough. This can easily be removed afterwards with hot water. If only one room in a house has to be fumigated, it would be better not to fasten the windows, so that they can be opened from outside for ventilation. Now put 18 fluid ounces of water in each of the six dishes—I am still alluding to a room of 16 x 12 x 14 feet—add 4½ fluid ounces of sulphuric acid. This is best done with an enamelled ladle, which has been marked inside for the necessary quantity. Never put water into the acid, or the fluid will spatter over, burning your hands and clothing. See that everything is ready, and especially be careful not to leave cats, dogs, or cage-birds inside. Take the cyanide, which has been put up in 4½ ounce parcels, each in a thin paper bag beforehand, and drop them gently but quickly into the dishes, withdraw from the room, and close the doors well. The acid will soon penetrate through the paper, and the gasifying process commences; there will be, however, a few minutes before this happens, which permits of sufficient time to get safely outside. The room has now to be left overnight, and next morning open the windows first from the outside, and allow at least half an hour to elapse before entering. After that time it is safe to take the dishes out. A residue will be found consisting mainly of potassium sulphate, which ought to be buried; and as it is a good fertiliser it could be emptied into some holes under the trees or shrubs in the garden. After two hours of proper ventilation has taken place, it is quite safe to stay in the room. If it is necessary to fumigate during the daytime, the charge should be left in the house at least four hours before opening the doors and windows.

If a whole house has to be treated, it would be advisable to stay out all night; charge all rooms with the necessary amount of chemicals just before dark; lock all doors and windows, so that no stranger can gain admittance unawares; and also put a notice on the front door warning people not to enter.

If only one or two rooms have to be fumigated and must be left overnight, the other part of the house can only be occupied if doors, walls and ceilings are well closed, as the fumes might find their way through a crack, and thus endanger the health of people sleeping close by.

I would like to repeat again that the greatest care must be taken in working and handling all poisonous chemicals. If any cyanide or

sulphuric acid should remain over, put these in jars or bottles which can be closed tightly. Both these chemicals take up the moisture from the air and spoil quickly. The receptacles should be labelled with the word "*Poison*," showing the nature of the contents, and then put under lock and key out of the way of children and natives. This is absolutely necessary in order to prevent accidents occurring, and because the law requires such to be done.

It is dangerous to inhale the hydrocyanic-acid-gas. Should any unforeseen accident occur and anybody become overcome by the fumes, it must be borne in mind that fresh air is the best restorative. Take the person so affected outside, and use the restoratives which are employed in drowning accidents; that is, move the arms and massage the thorax of the sick person, but in cases of a serious nature, a medical man should be summoned immediately. However, if ordinary care is exercised, no such accidents should occur.

Sulphuric acid is also dangerous and must be handled very carefully. If some part of the body should get burned by it, use ammonia, such as Scrubbs ammonia, or Eau de Luce. Little drops on the hand can be washed off at once with an abundance of water. It is also well to remember, if a room under fumigation has to be entered, which ought to be done only under very exceptional circumstances, that the strongest gas is higher up, and creeping on hands and knees and keeping the breath in, is the most advisable method to follow.

Hydrocyanic-acid-gas only acts on anything that inhales air, and therefore eggs are not destroyed. In places where bugs, etc., are abundant, a second fumigation should be done about ten or fourteen days later so as to kill the young larvæ, which are likely to have hatched then.

Range of Use of this Gas for Various Household Pests.

The range of its use is very wide; the gas will, however, be mostly employed in destroying bed-bugs. This is quite natural if one remembers that bed-bugs are not only very annoying, but also play a serious part in transmitting disease. During a bubonic plague epidemic, for instance, this gas should be freely used.

Mosquitoes and house flies should also be destroyed by means of this gas. As shown above, the fumes used need not be very strong, and the work can be done during the daytime. Although a house might be well protected with screens in front of the windows and doors, some of these insects are sure to find their way in, and might be the agents in transmitting malarial fever, or other blood diseases.

Rats and mice, and the fleas on them, can also be killed by fumigation, but the fumes ought to be rather strong, and must be kept in a room at least for twelve hours. A short time ago, I fumigated a store room where groceries, meal and grain were kept, and the result was 31 dead rats and seven mice, at a cost of nearly £1 for ingredients.

Moths in grain and clothing can also be killed, but good results can only be obtained if these materials are well spread out to allow the fumes to get in.

I have fumigated fowl houses against mites and fleas with a very good result; some fowl ticks were also killed, but a spray as advised above should follow.

The fowl house (Plate CCXXIV.) can be covered with a strong canvas sheet or bucksail, as I have shown in orchard fumigation. Fowl eggs do not suffer by the fumes. I have made some experiments in order to prove this. On July 2nd, 1906, I set a hen with five eggs; on July 4th, I added another five eggs and all were marked with the date. On the latter date two of the first lot of eggs were fumigated for one hour in a glass vessel of 424·75 cubic centimetre space, with 10 grammes of cyanide, and the same quantity of sulphuric acid, and 40 centimetres water.

On July 6th other three eggs of the second lot were exposed to the fumes for two hours. Thus it will be seen that out of the ten eggs five were fumigated. On the 23rd of July, two chickens hatched out. Unluckily the hen had to be removed to another place; the remaining eight eggs were opened, and in seven of them the embryo was alive, but one of the unnumbered eggs was not fertilised.

To find whether the canvas or bucksail suffered by the fumigation, I placed two pieces of American duck, each six inches by six inches, marked number one and two. No. 1 was soaked in water for some time, and No. 2 remained dry. The cubic space inside the box was 3,654·12 cubic inches. I fumigated for three hours with ¼ ounce cyanide, ¼ ounce sulphuric acid, and two ounces water, which represents about 11 ounces to 100 cubic feet and was therefore exceedingly strong. Next day both pieces of cloth were examined carefully and no difference in the texture could be noticed.

Against termites, or white ants, it will be found that the hydrocyanic-acid-gas is too light, and although forced by means of a pump into the underground channels, the results do not warrant the time and trouble spent over it. Larger animals can also be destroyed by this gas. Municipalities and Corporations often use the hydrocyanic-acid-gas for destroying stray dogs and cats, and death is quick and painless.

Cyanide of potassium can be obtained from the Government Entomologist, P.O. Box 434, Pretoria, at cost price, in parcels of not less than 10 pounds. A letter should be written stating the purpose for which this chemical is required, and a remittance must in all cases accompany the order.

On enquiry, the Government Entomologist will also be pleased to mention firms which supply sulphuric acid in large or small quantities, and will also be glad to give personal demonstrations of how to employ this method of fumigation.

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No. III.]

ENTOMOLOGICAL NOTES.

By C. W. Howard, B.A., Acting Entomologist.

In another part of this "Journal" there appears an article on the Natal Maggot Fly, *Bengalia depressa*, a pest of human beings. This fly has been extremely abundant about Pretoria and Johannesburg during

the past season. Several full grown maggots were secured from victims in Pretoria, and the adult flies reared from them. These flies were then forwarded to Mr. E. E. Austin, of the British Museum, a specialist in this group of insects, who identified them as specimens of the species known as *Cordylobia anthropophaga*. Blanch. The range of the species is at least from Sierra Leone to Natal. There seems to be an opinion in Natal that this species breeds only in dogs, while the real Natal maggot fly infests human beings. I cannot say positively whether there are two species of these flies with similar habits or not, but judging from a comparison of the larvæ and adults of the species under consideration, with descriptions and drawings of *Bengalia depressa*, I am of the opinion that such is the case.

Recently my attention was called to a case of suffering from tick bites. The ticks entered a room in some mysterious way and bit the victims whilst in bed, causing inflammation, swelling, and very severe irritation in the portion of the body bitten. Upon investigating the case, I found that the attic of the house was full of bats, and the cracks in the walls of the attic were full of a large tick resembling the fowl tick, *Argas persicus*, except that it is circular in shape and not elliptical. The tick seems to be a rare one in South Africa, so far as I am aware having been found only in Cape Colony before, and is known as the Bat Tick (*Argas vespertilionis*). The bites of other very closely related ticks are considered poisonous to man, but this is the first occasion on which we have found this particular tick attacking man.

After closing up all the large openings, a very heavy charge of hydrocyanic-acid-gas was set off in the portion of the attic where the bats had congregated. The fumes killed many and the rest forsook the place for more congenial surroundings. All entrances were then closed up with strips of wood, or fine wire netting to prevent the entry of more bats, and the walls were covered with thick whitewash, to which a large amount of caustic soda had been added, in order to fill up all cracks and destroy the ticks.

I wish to call attention to a valuable paper, in the Botanical Section of this Journal, upon the South African Locust Fungus, by the Plant Pathologist of the Transvaal Agricultural Department. Mr. Pole-Evans has gone minutely into this question, and his results are worthy of careful consideration by every South African farmer. (C. W. H.)

EXTRACTS FROM EXCHANGES.

ON SINGLE JUDGING.

("*The Field,*" *February,* 1907.)

The system of single judging has been accorded a fairly exhaustive trial during the past few years, both at representative and local shows, and it seems to have emerged from the ordeal with only moderate success. Indeed, it might be warrantable to go further and assert that it has been found wanting, of which circumstance there is significant evidence in the decision of several societies to revert to the two-judge method. Among the various societies that were so enamoured of the alleged advantages of single judging as to accord a fairly extended trial were the Royal Agricultural Society and the Smithfield Club, whose exhibitions are the premier summer and winter shows respectively. For a time the system seemed to work satisfactorily as it did expeditiously, but it did not appear to improve with experience, and, in the end, both organisations deemed it prudent to revert to the former order of things and to rely on two judges with an umpire ready to give the casting vote when his services were required. The result of the innovation has been pretty much in accordance with reasonable expectation. In theory, the single-judge system is excellent, and if the services of thoroughly competent judges can be secured it is, perhaps, superior to any other, not only as conducing to expedition in the accomplishment of the work, but also in the educative sense, since the absence of anything in the nature of compromise in the decisions should certainly lead to superior consistency and uniformity in regard to the type of animals selected for the honours. The difficulty that was anticipated in regard to finding a sufficient number of judges willing or competent enough to act alone would seem to have been realised in actual experience, and hence the abandonment of the system not only at the leading but also at several county and local shows. The latest to return from the single-judge to the two-judge system is the Essex Agricultural Society, which, at its meeting last week, decided to appoint two judges for the more prominent sections of its forthcoming show at Chelmsford. We have always contended that except, of course, where the classes are very small, and on the score of economy if nothing else, the best results are likely to be attained by the co-operation of two judges. Theoretically, two judges may be inferior to either one judge or three since, in the event of disagreement, no finality can be attained without the services of a third. This may be admitted as a trifling defect in the two-judge system, but, in our opinion, it is of little significance compared with the advantages it confers. It is preferable to the three-judge system

in that the latter is cumbersome, and, besides, tends to increase the chances of unsatisfactory compromise, while, as compared with the single-judge method, it diminishes the risk of error, and, in the case of very large classes, makes distinctly for efficiency and success.

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SOME POINTS ON DRY FARMING.

(*"Pacific Rural Press," February,* 1907.)

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*This year has furnished one of the most striking lessons ever given Utah farmers concerning the relation of plants to water. When the heavy spring rains appeared it was generally believed that the yield of irrigated wheat and other grain crops would be extraordinarily large. Instead of this being the case, thousands of acres of wheat in the State were ruined by rust. Not a case of rust has yet been reported from the dry farms. This goes to show that plants, under our arid conditions, do not need extraordinarily large amounts of water, and that we are already near the danger point. When, in addition to our usually copious irrigations, we have an unusually heavy rainfall, the result is detrimental to our crops. This has made the farmers of the State look with more favour than ever on the dry farm as the home of wheat and kindred plants. A prophet is not needed to foresee that the events of this year point very clearly to a time when wheat, corn and other grains, and a large portion of our alfalfa, will be raised on the dry lands, while more profitable crops will cover our valuable irrigated lands.

Steam Ploughing.—The labour problem is, and, naturally, will continue to be, one of the serious considerations in any branch of farming. The beet grower, at the thinning time and at harvest, has difficulty to secure labour; the fruit grower, at picking time, must almost beg for assistance; the sheep-man, at shearing time, is sometimes also helpless for want of proper help.

When, in the development of the dry farm business, contracts were desired for the clearing and ploughing of thousands of acres of land, it was found that the people of the State were not prepared to undertake such large commissions. Besides, on the arid farm, where the yield per acre is comparatively small, it is necessary that all the operations be performed at a minimum cost. It was, therefore, necessary to look to steam power for assistance in the operations of clearing, ploughing, seeding and harvesting. The Utah Arid Farm Company, operating in Dog Valley, Juab County, was the first farming concern to use a steam traction engine successfully in clearing and ploughing brush lands. President James W. Paxman, of Nephi,

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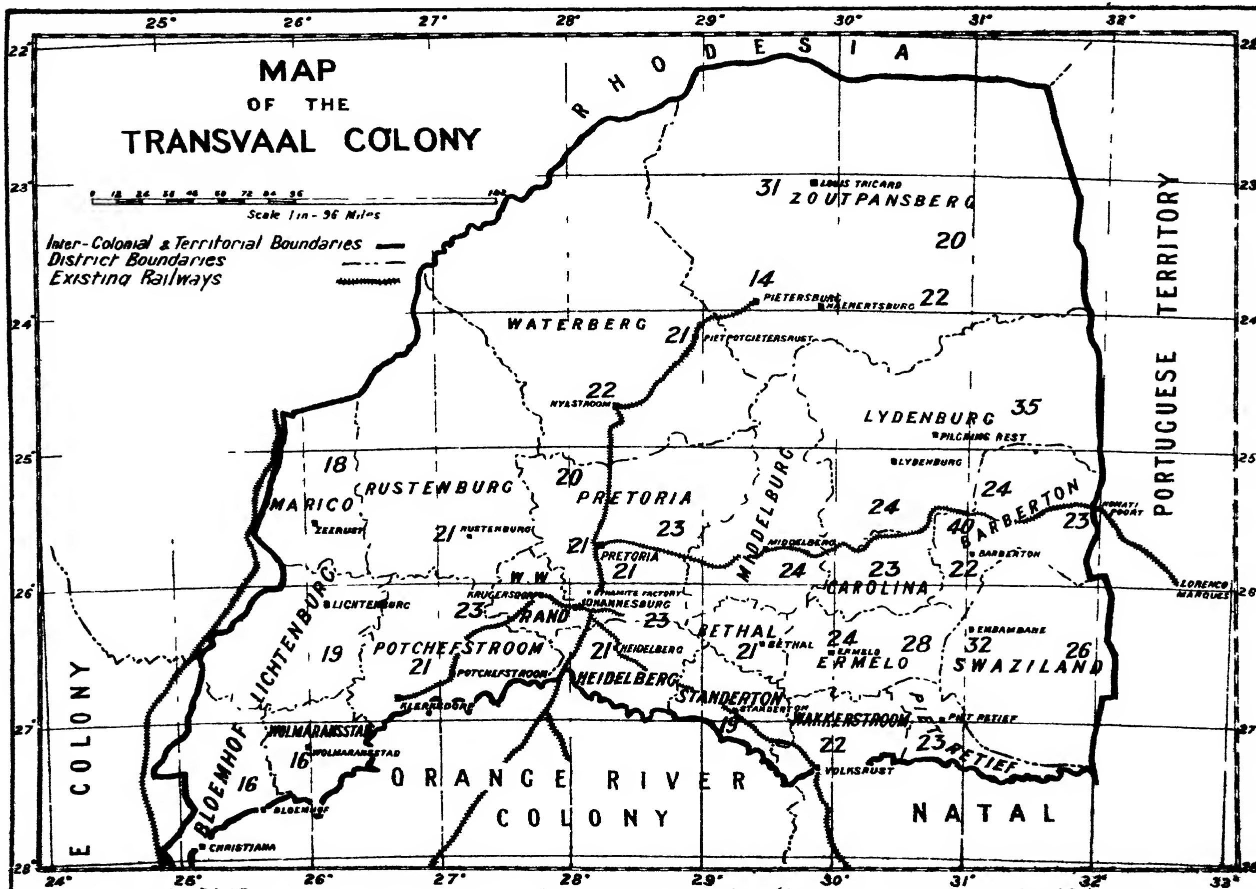
* This paper was written by Dr. J. A. Widtsoe, formerly Director of the Utah Experiment Station, who gave up his Station post to engage in dry land farming.—[EDITOR. "Agricultural Journal."]

Plate CCXXX.



Showing Annual Rainfall in inches for the Transvaal for the year 1st July, 1905, to 30th June, 1906.

followed, and is an enthusiastic advocate of the steam plough. This year several engines have been in operation, and the orders already placed indicate that twenty huge traction engines will be at work next year in preparing the deserts for the habitation of useful crops. Steam ploughing costs less than one-half as much as horse ploughing; moreover, a few men can operate an engine of the capacity that would necessitate the employment of a score of men if horse labour were employed. By means of traction engines the labour problem on the arid farms seems in a fair way to be solved. It is very fortunate that several makes of engines are at work at the present time, for, in that way, the relative merits of competing engines will be determined by practical experience.

A Coming Need.—The need of arid farming to-day is no longer that the people shall be awakened to the importance of the industry; it has now such an immense momentum that it cannot be stopped and will go on in spite of opposition.

To-day, the greatest need of the industry is water for culinary purposes within a reasonable distance of the farms. On Levan Hill, for instance, water must be hauled either from Nephi or Levan, a distance of upwards of eight miles. In Dog Valley, the farm there operated is obliged to haul its water four miles. Certain of the Cedar Valley farmers are ten to fifteen miles from water. The hauling of water adds greatly to the expense of the industry. Far more serious, however, is the fact that, as long as water cannot be found on these farms, homesteads will not be built on them. The most important consideration of those who are watching the development of the industry to-day is the question of how water can be obtained in order to dot the deserts with the homes of happy men, women and children. A recent bulletin issued by the geological survey estimates that the amount of underground water all over the world would make a layer of water 100 feet thick around the whole earth. Most of this water, it is stated, is within 1,000 feet of the surface.

Effects upon the Farmer.—In any review of the present condition of the arid farm industry of the State it would hardly be proper to omit mention of the important effect that arid farming has had upon the farmer. The development of this method of agriculture has done more than to convert thousands of acres of desert lands into blossoming wheat fields; it has taught the farmer careful and accurate methods of agriculture, which, in turn, has reacted upon all that the farmer has to do. Arid farming in this way has been a splendid schoolmaster, the effect of which is felt in all departments of agriculture within the State. The sugar beet business has similarly benefited the State, for the exact methods necessary to produce beets successfully have made better farmers. Arid farming is making better farmers than the State has ever had before.

A Warning to Investors.—Now that the era of arid farming is upon us, an old word of warning needs to be repeated. Arid farming, if it is successfully executed, requires first a suitable soil, that is,

a deep soil of uniform texture; secondly, a sufficient rainfall, that is, from ten to fifteen inches.* The future may show that less than ten inches of rainfall may be sufficient for the production of crops, but, with our present knowledge, ten inches of rainfall will not produce very profitable fields. If a farm possesses the suitable conditions of soil and rainfall, the farmer must go ahead and till that soil according to the best and most scientific methods known. Careless and haphazard ways of farming may produce fairly good crops on irrigated lands, but they will never do so on an arid farm. Only those who are willing to obey implicitly the results of the best experience will succeed in this difficult method of farming. It is to be said, however, that those who are going into the business should inform themselves thoroughly as to the climate and other conditions prevailing in the place considered, and also regarding the right methods of producing crops without irrigation. Only when this is done can success be expected.

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THE EVOLUTION OF THE BACON HOG.†

("*Farming World,*" *February*, 1907.)

The evolution of the bacon hog in Ontario Province was, without doubt, the highest achievement of the Department of Agriculture while under the guidance of the writer as its head.

Times of deep depression existed among our farmers in the early nineties. Products which had brought a good revenue were no longer wanted. Grain growing had occupied, for many years, the chief place among farm products, but these were no longer profitable. It was necessary to turn to other lines of production. Among those at that time likely to give some relief was the production of superior bacon for the English market. But our swine were not suitable for the purpose. The Ontario farmer had developed the thick, fat type, using Berkshires, Chester White, Poland China, and like breeds. As bred at that time, none of these were suitable for prime bacon. After a few years, Tamworths began to be introduced, and also the small Yorkshire. These were used for crossing on the other breeds, but only with partial success, but what was worse (looking to the future) many influential farmers refused to use what were then called "razor-backed" hogs, having been always accustomed to the so-called easy feeding breeds. Over and over again the writer was told if he could present them with these lean breeds they would not keep them on the farm. We could not coerce them. How, then, could they be convinced as to the only proper course to take was the problem which

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* In this connection the map showing the rainfall of the Transvaal will be of interest; at the same time it must not be forgotten that arid America receives annual snows.—[EDITOR, "Agricultural Journal."

† Paper prepared by the Hon. John Dryden, formerly Minister of Agriculture for the Province of Ontario, for the annual meeting of the American Breeders' Association, held at Columbus, Ohio, January 15th-18th last.

faced the Agricultural Department. If we were to make an impression on the English market it was necessary to produce a good bacon type over the whole country, and not merely at a few points. Some progress had been made in a few districts, but, generally, the quality of those offered was away below the proper type.

At that time we had an annual perambulating fat stock show, supported in part by public funds. Experience, however, soon convicted those in authority that to see the animals was not sufficient. Information must be given. But this could not be without proper provision for a meeting place, and that must be in connection with the show buildings. Accordingly, a settled home was found at Guelph, where extensive buildings were erected, not merely housing the show but furnishing an appropriate lecture room where the live animals could be taken on the platform; as also a killing room and a cooling room. With these appliances the educating campaign commenced as follows: First, large prizes were offered for bacon hogs of suitable weight ready for slaughter. The pork packing companies were asked for three experts to judge them. These were instructed not merely to select the best, but, if none offered reaching the ideal first quality bacon, no first prize should be given, nor second, nor third for the same reason. The first year we failed to find the ideal pig, and, accordingly, no first nor second prize was awarded. The second year showed much improvement, while the third year brought several specimens which were fit to rank as first class. Then came our educational campaign. All the speakers for our Farmers' Institutes were asked to be present to listen to the discussions. The ideal hog was brought on the platform along with others of an opposite type. The experts from the packing houses were asked to explain to the large audiences why this type was required and what class of bacon it would produce. The audience had full latitude to question the speakers. The same evening these pigs passed through the killing room and the next afternoon were presented in the form of sides of bacon, so that the first day's lesson was verified and the conclusions shown to be correct. This course convinced the most sceptical, and the murmurings about the breeders very soon entirely ceased. But it did more, it enabled those breeding foundation stock to discover the particular form of animal which, when slaughtered, gave the best bacon. Careful selections were made by some of our best breeders, until I am ready, to-day, to make the claim that in the Province of Ontario we have a type of bacon hog not excelled in any country the world over.

But our efforts at this show, now known as the Winter Fair, could not reach the masses of our people. To do this the Farmers' Institute system was utilised. It covers every electoral division in the Province. In each of these meetings of farmers are held annually. The speakers, after their attendance at Guelph, where the lectures and the discussion had been held, were prepared to speak on the subject with accuracy and authority. "The Bacon Hog" was made a

compulsory subject for three years by the Department. So that, in every county over the whole Province, the gospel of superior bacon was declared almost simultaneously. The living animal could not be used in halls and school houses, but a substitute was found in full-sized photos of the ideal hog, as well as the sides of bacon, as shown at Guelph. Thus, in every county and, practically, at every meeting, the various speakers were telling the same story. At the end of the third year the work was so complete that, at every shipping point, the uniformity became a subject of general comment. The ultimate result is now seen in the place Canadian bacon has won for itself on the English market.

In order to produce the foundation stock for the best bacon production no breeder in our country has resorted to close in-breeding. The present high and uniform quality has been attained entirely by selection based on the killing tests. The animals reserved for breeding in the pure-bred herds were selected to supply the same type which, year after year, won a first place in the killing test. The result is that, along with a wonderful uniformity and excellence, we have a ruggedness and strength of constitution very much to be desired. The animal developed is not ugly in appearance, though our farmers generally have concluded that "handsome is as handsome does."

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A CO-OPERATIVE BACON FACTORY.

The value of the pig as a domestic animal is becoming greater every year owing to the immense development of dairy farming, and the conversion of the separated milk of creameries into bacon. English experiments show that a gallon of separated milk is equal to 1½ lbs. of barley or rye as a feeding material. The following extracts from a paper on Co-operative Bacon Factories, read by Mr. London M. Douglas before the Gloucestershire Chamber of Agriculture, will be of interest to our own farmers. [EDITOR, "T.A.J."]

A MODEL FACTORY.

In this county I would suggest that the factory that is desirable should be made available for the handling of 250 pigs per week, and that number would form the nucleus of a paying concern, and it would be easy to design a factory which, with comparatively little expense, could be doubled in size when the business developed. A profit, at the price of pigs and bacon at the present time, of between 4s. and 5s. per pig could be realised, and this for the bacon alone, but, of course, there are other departments in connection with bacon curing, such as sausage making, which are extremely profitable, and would add considerably to the total profits to be obtained.

In so far as the factory is concerned, I may say that I have come to the conclusion, after having been concerned in the designing and construction of very many factories, that it is quite possible to construct a cheap factory which will give every possible facility for conducting the trade, and some appropriate figures on this side of the

question will no doubt be of interest. A factory to handle 250 pigs per week, fitted with every modern appliance necessary, could be erected and equipped for about £3,000. Where a quantity like 500 pigs per week is available, the initial cost of the factory might be set down as between £5,000 and £6,000, where 1,000 pigs per week are available the cost would be about £7,000. In designing the smaller factory, however, the cellarage and chill rooms can be so laid out that they can be added to at will, and so the locking up of capital to begin with can be avoided. Basing our calculations, therefore, on the supply of, say, 250 pigs per week, it would be necessary to provide a sum of about £6,000 altogether. This would be necessary because of the working capital which would be required. There is no credit given in the live pig trade, and the bacon factories have to pay cash down. They do not get the money back again for three or four weeks thereafter, so that the working capital required must be the value of the pigs multiplied into, say, three weeks. I would not recommend the starting of a factory without the capital being assured, as while advances may be obtainable from the banks, it is a serious handicap in the starting of a new business.

This is not an occasion upon which it would be desirable to examine the technique of bacon curing; there may be other opportunities for doing that. I may, however, be permitted to briefly state the kind of factory that would be necessary, and the operations which would be carried on within its walls.

An economical factory usually takes the form of a hollow square, and would rest preferably in one storey on a piece of ground about 200 feet square. If you will imagine a piece of ground like this covered with, say, five parallel roofs at an elevation of about 15 feet to the wall plate, you will form an idea of the kind of factory I would suggest. The construction could be of the cheapest character, and the roofing of galvanised iron, or other cheap material. The only really substantial parts of the buildings would require to be the cellars themselves and the engine-room.

The operations in such a factory are easily described. The pigs are driven into pig styes, where they are rested; they are then driven one by one into a shackling pen where they are hoisted to a bar, head downwards, and they are at once despatched and all the blood allowed to run out. The carcases are then rolled into a scalding tank, where they are allowed to remain until the hair can be easily removed; they are then rolled on to a scuttling table, where they are scraped, and immediately they are hoisted into a vertical singeing stack, where they are subjected for about a quarter of a minute to intense heat. This fire has the effect of hardening the rind, and also imparting a flavour to the meat. There are, of course, other methods of treating pigs for special purposes, but as the principal demand in this part of England is for bacon known as the "Wiltshire Cut," it will be as well to follow the operations in connection with that particular kind of meat. After the singeing operation, the carcases

are cooled in a cold bath and at once suspended on a bar where they are scraped quite clean, and the intestines are removed, and they are utilised in various different ways. The carcases are then allowed to hang in a hanging house until the excess of animal heat has been given off. They are then split down into sides and are placed in a chill room where they are reduced in temperature to about 40° Fahr. When that temperature has been reached, the sides are taken into the curing cellar and pumped in a great many places with a pickle or brine, the constitution of which is well-known. The sides are then sprinkled over with an equal mixture of saltpetre and antiseptic, on the top of which a layer of salt is placed; one side is laid on the top of the other until a depth of eight or so has been reached, and they are allowed to lie in this condition from twelve to fourteen days. During that time the curing materials slowly melt and penetrate the tissues of the meat, and effect the cure, that is to say, they stop rapid decomposition.

It is a curious thing that, as the curing materials penetrate the tissues, the soluble albuminous compounds pass out, and this is a rather unfortunate part of the business, because these albuminous compounds, being of highly nutritive value, are simply replaced with substances which have no food value whatever. At the end of fourteen days the meat may be said to be mild cured and can be taken out of the cellar, and is then ready for market as green meat, but as the demand is very largely for smoked meats, the sides may then be placed in the smoke stoves for two or three days, and they would then be ready as smoked meats.

This brief outline will give you an idea of the operations, and, as you will see, they are not of a complicated character. At one time, and not so very many years ago, the process of curing bacon was considered to be a great secret. With the aid of chemistry, however, the secret has been reduced to a mere process of routine which can be acquired by all who may apply themselves to the business.

The principal feature of curing is the machinery. There must be a full complement of mechanical appliances, and the principal of these is the refrigerating machine, upon which the temperature in the chill room and cellars absolutely depends. A constant temperature is what is wanted, and constant curing conditions can only be obtained by the construction of suitable rooms, the atmosphere of which is under the control of mechanical refrigeration. The reason of this is that the public taste now-a-days is for mild cured meats, and it is quite impossible to cure meat in a mild way except in a constantly cooled atmosphere.

RURAL NOTES.

Bethal.

February.—Heavy rain fell during the month—an average of five inches. Crops are looking well. New ground has been ploughed extensively. There is every prospect of a fine mealie crop, as also of potatoes. Veld grass has been cut and harvested in large quantities. Peaches are plentiful and good. The current price of mealies is 13s. 6d. per 200 lbs. and forage 6s. 6d. per 100 lbs. The condition of live stock is good. Grazing and water are plentiful, and the prospects for winter keep are good. Native labour supply is fair—wages £1 to £3 per month.

March.—There has been very little rain for the season of the year since the heavy falls early in February. Ploughing has been continued where possible. Forage has been harvested, and generallv speaking is good; the rust has in some instances affected it. Potatoes and mealies do not promise so well as at first expected on account of lack of rain. The current market prices are as follows:—Forage on the whole is good, about 5s. per 100 lbs.; mealies, 11s. per 200 lbs.; oathay, 5s per 100 lbs.; manna, 3s. 6d. per 100 lbs. Live stock, where not affected with disease, are in fair condition. Grass and water are plentiful. Native labour supply is plentiful at from £1 10s. to £2 10s. per month

Boksburg.

February.—Rainfall for the month registered 5·93 inches. The rainfall has been heavy and continuous with one or two violent thunderstorms. Cool, cloudy, and damp during the month. In this district the mealie crop will show a record. Fruit seems to have suffered from the heavy rains coming just as the crops were ripening. Potatoes are plentiful and cheap. On the whole, the farmers seem fairly satisfied and pleased with the season. The current market prices are as follows:—Peaches, 1s. 6d. per 100; pears, 3s. per 100; fowls, 2s. to 2s. 9d. each; eggs, 2s. per dozen; mealies, 10s. to 13s. per bag; forage, 6s. 6d. to 7s. 6d. per 100; bran, 9s. 6d. to 10s. 6d. per bag; tomatoes, 2s. per large basket. All live stock are in the best of condition. The majority of dams and pans are overflowing. Many farmers are preparing for winter crops. Native labour is plentiful for domestic purposes.

Carolina.

February.—Genial weather prevailed during the month; there was heavy rain in the first week, and the remainder of the month was fine with occasional shower

Blue-tongue is prevalent amongst sheep, and losses this year are unfortunately rather heavy. The new " three days sickness " has at date

of writing infected the whole of this district, spreading with extraordinary rapidity from end to end of the country. The disease is not fatal. Horse-sickness has been bad, and has invaded portions of the high veld where it was formerly unknown.

Fruit and vegetables are very plentiful, and of good quality. The improvement in the weather has resulted in an improved flavour in the fruit.

Forage, the only crop sold in any quantity, is held back by the farmers, sales are at 5s. and 6s. per 100 lbs.

Ermelo.

February.—Rain fell on nine days during the month and the rainfall registered in Ermelo town was 7·89 inches; the heaviest for one month during the present season. During the intervals of fine weather, the temperature was quite hot for the high veld. Extensive reaping of oat crops was carried out during the month, the yield of which was a record one, but owing to heavy rains a large proportion of the crop has been damaged. The mealie crop, which was also expected to be a record one, has been considerably damaged in low-lying lands, notwithstanding which, a crop above the average is expected owing to greater areas than ever before having been cultivated. There is an abundance of fruit, principally peaches. Vegetables are also plentiful. All live stock are in very good condition. There is plenty of water, the veld is good and the prospects for winter keep are regarded as better than in many former years. There is a movement on foot to establish a creamery at Breyten. The native labour supply has been abundant, wages being from 10s. on farms to £2 per month in town.

March.—Rain fell on nine days during the month, the total rainfall having amounted to 5·83 inches. The heaviest rainfall occurred on the 2nd and 3rd of the month; no less than 3·71 inches having been registered. Warm weather prevailed throughout the month. The reaping of oathay and manna, and haymaking occupied most of the time of the farmers during the month. They were lucky in having seasonable weather for this work. A lot of new ground was broken up during the month for the ensuing season and the mealie crop promises to be a very good one. As a late frost is anticipated, the total crop is expected to be reaped. The following are some current market prices:—Oathay is plentiful at 4s. per 100 lbs.; and potatoes at 5s. to 7s. 6d. per 150 lbs. The supply is considerably in excess of local demands. All live stock are in excellent condition, pasturage is still plentiful and an easy winter is anticipated. The native labour supply is plentiful—wages rule from 10s. to 15s. on farms and 30s. to £3 in town. The Annual Agricultural Show was held here on the 14th of the month. There were comparatively few entries in the various classes, but the actual exhibits were on the whole good. Some very good samples of locally grown lucerne were exhibited. On the afternoon of the day of the show, a meeting of farmers was held with a view to starting a Farmers' Co-operative Association. Mr. Nicholson, the Secretary to the Agricultural Union, explained the broad outlines of the scheme. A

working committee was appointed for the purpose of approaching all agricultural societies throughout the Transvaal, with the idea of promoting this object.

Some time ago a scheme was mooted to establish a creamery for the benefit of the settlers in the Lake Chrissie Ward, and it was decided to place the site of the creamery on the farm " Florence," which is on the outskirts of the Lake Chrissie Settlement. It was, however, decided that a creamery could not be run successfully in the Lake Chrissie Ward, owing to the small number of cows available, and the fact that the creamery could not be run throughout the year, owing to the poorness of pasturage throughout the winter season. At a settlers' meeting, some little time back, it was agreed that the site of the creamery should be at Breyten. It is considered that a creamery could be run successfully here, as all farms within a certain radius of the railway from Ermelo to Breyten, Bethal to Breyten, and Carolina to Breyten would be able to participate in such a creamery. Furthermore, it could be run throughout the year, as a lot of winter fodder is provided in the western portion of the district, in the shape of hay and large mealie lands. The matter is now under the consideration of the Land Department.

HEIDELBERG.

February.—During the beginning of the month good rains fell, but during the middle part hardly any fell. Towards the end it again rained in most parts of the district. The breaking up of new soil is being carried on nearly all over the district. No harvesting has been done yet to a great extent, but some manna and oats are turning ripe. Although some crops have suffered through too much rain in some parts of the district, they are looking very promising generally. The condition of live stock is very good, as also the veld. The water supply is abundant and should last during the winter. More natives seem to go about seeking work, but they demand high wages—about £2 10s. to £3 per month.

March.—The rainfall not as great as could be wished. All agricultural operations have practically been brought to a standstill, owing to the desolation wrought by locusts. Up to the middle of March the prospects were brighter than ever before; more land had been brought under cultivation and the season was the best experienced for many years, but now practically all the crops in the district, with a few fortunate exceptions, have been destroyed. Not much produce has been brought to the market, as the farmers seem to keep back the better produce. Mealies were sold at about 11s. to 12s. a bag, manna about 3s. 6d. and oats about 5s. a 100 lbs. Potatoes fetched from 4s. to 5s. per bag. Live stock are in good condition. The veld has on many farms been destroyed by locusts, which will in some cases necessitate the removal of stock to other farms. The prospects for winter keep are, therefore, bad, though the practice of cutting hay for winter use is on the increase. The water supply is good. The native labour supply is normal. The Heidelberg Agricultural Society propose to hold their first show on the 8th May.

Klerksdorp.

February.—The rainfall during the month registered 8·07. On the 4th February 4·73 inches of rain fell, causing the Schoonspruit to overflow its banks, and the Vaal River to rise 21 feet. The climate has been mild, with the exception of a few very hot days. Farmers are busy breaking up new ground for next season. The mealie crops, where not destroyed by locusts, are doing well. Fruit and vegetables have suffered somewhat through heavy rainfall. The following are some current market prices :—Butter. 7d. to 10d. per lb. ; ducks, 1s. 6d. to 2s. ; fowls, 1s. 3d. to 2s. ; eggs, 1s. 6d. to 2s. per dozen ; firewood, 15s. to 30s. per load ; forage, 7s. 6d. to 15s. per 100 bundles ; Kaffir corn, 8s. to 10s. per 200 lbs. ; mealies, 10s. to 12s. 6d. per 200 lbs. ; meal, 22s. 6d. to 25s. per 203 lbs. ; wheat, 15s. to 18s. per bag ; onions, 2s. to 5s. per 123 lbs. ; potatoes, 5s. to 13s. per 160 lbs. The flood on the 4th February caused considerable damage. It is estimated that about 75 per cent. of the dams in this sub-district have been washed away. Gardens, crops, and lands in the valleys have been destroyed, and a certain amount of small stock was drowned. Stock and veld are in excellent condition. Water is plentiful everywhere and the prospects for winter keep are good. The native labour supply and wages are normal.

March.—Rain has fallen at regular intervals, registering 3·42 inches for the month. Weather has been mild, with alternate hot and cold days. Farmers are still busy breaking up new ground for next season. Locusts have made their appearance in abundance and have done considerable damage to standing crops, namely, mealies, Kaffir corn, etc. Fruit is becoming scarce, but vegetables are fairly plentiful still. Two Government jumper water-bores are still operating in this sub-district and continue to give satisfaction. Preparations are being actively carried on for the forthcoming annual show, to be held on the 17th April next. Considerable improvements have been made on the grounds by the erection of extra shedding, permanent cattle and sheep pens, etc. Page's wire woven fencing is being extensively used and is giving great satisfaction, both for neatness, strength, and labour saving. Stock are in good condition. The veld is being demolished by locusts, leaving only the coarser grasses The native labour supply is the same as last month.

Lichtenburg.

February.—A considerable amount of rain fell in the early and latter part of the month with fine weather in between. A fair amount of new land has been broken up. All fruit is now practically finished, with the exception of clingstone peaches and quinces. This has been a very fair season for fruit, but there is no market. It has been an excellent season for mealies so far and farmers have every prospect of a very successful harvest. The supply of vegetables has been good, but there is very little demand. The following are some current prices of crops :—Mealies, 10s. per bag ; Kaffir corn, 8s. to 9s. ; oathay, 16s. per 100 bundles ; potatoes, from 8s. to 14s. per bag ; On the whole, the condition of live stock is good. In the western portion of the district, there have been about 80

deaths from gall sickness, but otherwise there is very little disease among stock. Water and grass are plentiful. Native labour remains scarce.

March.—The rainfall for the month registered 1·21 inches on seven days. Large swarms of locusts have done a great amount of damage. Roughly speaking, only about 40 per cent. of the mealie crop in the district will be saved. The Kaffir corn crop has not suffered so much. The return of the locusts has spoiled the prospect which there was of a record harvest of mealies. The places where locusts have camped are pretty well swept of grass, and good rains are wanted to improve the veld before winter. The current market prices are:—Mealies, 10s. to 12s. per bag; Kaffir corn, 8s. to 9s. per bag; potatoes, 8s. to 12s. per bag; oathay, 18s. per 100 bundles; vegetables are still offered in good quantities and cheap. Native labour is scarce and the wages are from £1 to £2 per month and food.

MIDDELBURG.

February.—Very heavy rains fell at the commencement of the month. Slight showers in the middle of the month, and dry and windy at the end of the month. A good deal of new lands have been broken up. A great deal of tobacco and mealies in low-lying lands have been spoilt, owing to the exceptionally heavy rains. Most of the fruit crop this year is poor, due to heavy hail storms in spring. The condition of cattle during the month has been bad, owing to the heavy rains; as there is too much water lying on the veld. Native labour is still scarce, and the current rates of pay are £1 to £2 per month.

March.—The weather has been dry, with a few light showers. The progress of crops is good, and farmers have been busy during the month cutting their manna and wheat. Oathay fetches 7s. per 100 lbs. on the market; and mealies 12s. per sack of 200 lbs. The condition of stock is improving greatly. Water is plentiful, and the prospects for winter keep are good. Native labour supply is badly needed.

POTCHEFSTROOM.

February.—Rainfall for the month registered 6·32. On the 4th February, 1·66 inches of rain fell, causing the Mooi River to overflow its banks. The climate has been mild, with the exception of a few very hot days. Farmers are busy breaking up new ground for next season. Mealie crops not destroyed by locusts are doing well. Stock and veld are in excellent condition. Water is plentiful and the prospects for winter keep are good. The flood on the 4th caused considerable damage. It is estimated that most of the dams in this district have been washed away. The Vaal River and Schoonspruit overflowed their banks, and gardens, crops and lands in the valleys were destroyed and some small stock were drowned. Labour supply and wages are normal.

STANDERTON.

February.—Heavy rains fell during the month and the Vaal River overflowed its banks. No hail storms were reported. Most of the farmers,

preparatory to harvesting their crops, are breaking up new ground. The principal product harvested this month is the oathay, good quantities of fair quality having been marketed. The yields of oathay and potatoes are particularly good this season, and prices are lower in consequence. The condition of the live stock is good, and the prospects for the winter keep very promising. The labour supply remains unchanged.

The second Annual Agricultural Show to be held at Standerton on the 27th and 28th of March promises to be a huge success, and the Committees are working hard with this end in view. They are holding the show this year at the south-east end of the town, on a piece of ground allotted to them by the Town Council.

March.—The weather has been dry during the month, with one or two slight showers of rain. The harvesting of crops has begun. The fruit season, such as it is in this district, is at an end. There are still a few vegetables obtainable in the district. Oathay is particularly good, and fetches 5s. to 6s. per 100 lbs.; mealies, 10s. to 12s. per bag. The live stock continue to keep in good condition. The veld is drying up and is looking quite brown. There is still a good supply of water. It is anticipated that more rain will yet appear and freshen up the veld. Most farmers have a little stock for winter. The labour supply remains unchanged. There are no doubt plenty of natives available, but they expect high wages—from 25s. to 40s. per month.

The second Annual Agricultural Show was held here during the latter part of the month. The show was opened by His Excellency, Earl Selborne. It is regretted, however, that on the whole, the show was not such a success as the first one owing, no doubt, to the fact that a number of cattle were suffering from ephemeral fever, sheep from blue-tongue, and horses from horsesickness, and that a counter attraction for the inhabitants of Vrede, who attended the first Standerton Show, was provided by the holding of a show there. However, the Committee report that the Association show a small balance on the right side, and hope with increased efforts and better conditions to make the show a greater success than ever next year.

VOLKSRUST.

February.—Up to the middle of the month a great deal of rain fel and the ground is very wet and sodden; 10·40 inches fell on 17 days. Maximum temperature, 80·0 on 20th. Minimum temperature, 50·0 on 14th. The progress of crops has been slow, owing to the excessive rains and the very wet condition of the lands. The mealies, however, are well advanced and promise a large yield. Forage is in good condition and harvesting operations are carried on as weather permits. The potato crop is practically ruined. It is rotting in the ground, which is too wet for the potatoes to be harvested. Fruit crops are backward for want of sun, and vegetables are not too plentiful. This year's crops are just coming on to the market. Stock generally are in excellent condition. The second Annual Agricultural Show was held on the 27th and 28th ultimo. No great improvement was noticeable in horses, but in cattle and sheep there was a very decided advance. Sheep especially were an excellent lot, and some valuable stud rams were exhibited.

March.—The weather during the month has been much [illegible] n the preceding month. Towards the latter end thick mists were experienced in the early mornings. Maximum temperature, 81·3 on 21st. Minimum temperature, 45·0 on 4th. Rainfall, 2·93 inches on 12 days. The farming outlook during the month has greatly improved. The forage and mealies are now in splendid condition and promise a heavy yield. Amersfoort reports a severe wind storm having passed over that place on night of the the 16th instant, lasting about two hours. The Elandsberg range from Vlakpoort (232) to Waschbank (364) during the same night experienced a severe hailstorm, and considerable damage was done to the crops. Most of the crops in the Amersfoort area appear to have suffered more or less during that night. Locally no wind of this kind was experienced. This season's crops, except potatoes, are not yet to hand. The local prices of new potatoes are 7s. 6d. to 12s. per sack; 6s. per 100 lbs.; 5s. per 100 lbs. If present favourable weather continues for another six weeks, the crops will be well up to the average, and the forage crop much in advance of last year's. Stock generally are in good condition and there is yet abundant grazing, and water in plenty. Native labour is scarce.

WAKKERSTROOM.

January.—Heavy rain fell at intervals throughout the whole month, with very little sunshine. The hoeing of crops was proceeded with when farmers were not prevented from working owing to the rain. Turnips and Algerian oats have been sown and potatoes planted. Sweet potato cuttings have been planted out for 1908 winter crop. Garden seeds, like carrots, beet, parsnips, etc., have been sown. The condition of crops are backward owing to the superabundance of water and the minimum sunshine. The price of mealies ranges from 12s. to 15s., and forage 6s. per 100 lbs. Cattle are looking fair, also horses, but sheep and goats are not in very good condition. The labour supply remains as usual.

February.—Much rain fell throughout the month, with warm days between the wet days. The scuffling of mealies took up most of the time of the farmers. Potatoes were earthed up and cleaned. The prospect of the mealie harvest is not much better than the average—below the Berg the crop is better than above the Berg. Mealies fetch 9s. to 10s. per bag; forage 17s. to 20s. per 100 bundles. Vegetables are looking well. Cattle are in good condition. Sheep are weak and lame, through too much wet. The prospects for winter keep are very good.

March.—The weather was damp throughout the month, especially towards the end. Several severe hailstorms occurred about the middle of the month, doing much damage to mealies and tobacco, etc. The farmers are busy breaking up ground for next summer's cropping, and harvesting early mealies. Mealies promise only a medium crop below the Berg, where crops are sown along spruits and low-lying places, for the rain has drowned a large proportion of them. Lucerne that was sown in many places has suffered through the rank growth of weeds. Cattle are in good condition and sheep are picking up somewhat from the effects of earlier excessive rain. Veld feeding pigs are in good flesh, owing to the softness of the ground, allowing them freer access to their root food. White labour is plentiful at 2s. 6d. per day with food, but native labour is rather scarce.

USEFUL FACTS AND FIGURES FOR FARMERS.

HOW TO SELECT POULTRY.

In selecting poultry, the age of the bird is the most important question. In selecting a turkey, remember that a young bird has smooth, shiny black legs, while those of an old bird are rough and reddish. If the bird has been freshly killed, the eyes are full and bright and the feet moist.

The combs and legs of a chicken are smooth in a young fowl and rough in an old one.

When selecting geese, see that the bills and feet are yellow and have few hairs on them If freshly killed, the feet should be pliable, for after they have been killed some time they are dry and smooth.

Ducks are chosen by their feet, which should be supple. Wild ducks have reddish feet, while those of the tame ducks are yellow. A fresh duck should have a plump hard breast.

Tame pigeons are larger than wild ones and the feet show the age of the bird. They are supple if the bird is young, and stiff if it is old. Pigeons are only good to eat when they are fresh. When they have been kept too long they become flabby and discoloured about the under part. —"The Florida Agriculturist," February, 1907.

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HOW TO USE LIME.

Some commonsense directions for using lime are given by Mr. F. E. Lee, of the Agricultural Department, in the current issue of the "Journal of Agriculture." Mr. Lee describes the different forms of lime, and its functions in connection with various kinds of soils, and then he indicates when and how lime should be applied. He says: Before the maximum benefit can be derived from the use of lime, the object with which it is given must be clearly understood. If it is desired to break down stiff clay soils, caustic or burnt lime should be used, so that the double object of correcting acidity and improving the physical condition of the soil may be achieved. If it is desired to arrest the rapid drainage of sandy soils, slaked or mild lime is best. For peaty soils, caustic lime is preferable, because it promotes decomposition more rapidly; for newly drained land caustic lime is best on account of the usually high degree of acidity in such soils, and also in order to assist in the free passage of air and warmth. Under no circumstances should lime ever be applied within at least five or six weeks of the sowing of seed or artificial manures. The proper time to apply lime is in the early autumn, and it should be distributed broadcast, or by mechanical spreaders. Lime should never be ploughed in, but is best applied immediately after ploughing, and then harrowed in. The logic of this will be readiy grasped when the reader considers that it is th' upper portion of the soil in which plant roots mostly feed, and every

effort should be made to improve that portion of the soil. If the lime were to be ploughed in, the effects of it would only commence six inches below the surface, and the objects desired would be defeated.—" The New Zealand Farmer, Stock and Station Journal," January, 1907.

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CURING MEAT.

An excellent recipe for curing meat appeared in one of our exchanges, and is as follows :—To one gallon of water add one and one-half pounds of salt, one-half pound of sugar, one half ounce of potash. This gives the ratio ; in it the pickle can be increased to any quantity desired.

The ingredients named are to be boiled together until the dirt rises to the top and is skimmed off. Then turn into a vessel what has thus been prepared and let it cool. When cold pour it over the beef or pork. The meat must be well covered with the pickle, and should not be put down for at least two days after killing, during which time it ought to be lightly sprinkled with saltpetre ; this removes all the surface blood, leaving the meat fresh and clean.

The boiling of the pickle is sometimes omitted, but it should be remembered that the boiling is a purifying process, throwing off the dirt always found in salt and sugar.

This recipe has only to be tried to prove its superiority over the common way of curing meat. The meat cured by this process is unsurpassed for sweetness, delicacy of flavour, and freshness of colour.—" Journal of Agriculture," Western Australia, January, 1907.

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HOW TO DISSOLVE BONES.

Cover the bottom of a tub or hogshead with six inches of dry soil. On this place the same depth of bones, and cover entirely with wood ashes. Repeat these layers till the vessel is filled. After exposure to the weather during the summer and the winter, the whole mass can be readily reduced to powder, and thus form a valuable manure for digging into the ground in spring.—" Queensland Agricultural Journal," January, 1907.

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POTTING PLANTS.

New pots should be thoroughly soaked and dried before being used, and old ones must be well washed. Before putting in the soil, provide drainage by putting a piece of broken pot over the hole in the bottom. Then put in a number of small pieces. To ensure good drainage, place some fibrous turf over the potsherds. This will keep the finer particles of soil from working downward and stopping the free course of the water. The

pot soil should be a rich light compost, nicely damp. If wetted too much. some composts will knead together like dough, and will crack and shrivel. If too dry, the delicate root hairs are injured. Do not pot soft-wooded plants too firmly, but hard-wooded ones with wiry roots require firm potting. The old plan of standing pots in saucers is a mistaken one, except in the case of semi-aquatic plants. The roots require free access of air to the hole at the bottom.—"The Queensland Agricultural Journal," January, 1907.

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TO CALCULATE THE HEIGHT OF A TREE.

The exact height of any tree may be ascertained by the help of a stick, the sun, and a simple sum in proportion. Take a stick of any length from six inches to say two feet. Plant it in the ground so that the portion above ground represents an exact number of inches. Now note if the tree is upright or leaning. If the latter, incline the stick at as nearly the same angle as possible at which the tree inclines. Then measure the shadow of the stick and also the shadow of the tree. The proportionate lengths of the shadows of the tree and stick, and of the stick itself, will give the height of the tree.

Example.—The height of the stick from the ground is six inches. It throws a shadow of eight inches. The shadow thrown by the tree is 40 feet. The question then is: If a stick six inches in length throws a shadow of eight inches, how high should a tree be to throw a shadow of 480 inches? As 8 : 480 : 6 : : 360, or 30 feet, which is the height of the tree.—"The Queensland Agricultural Journal," January, 1907.

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STORING FRUIT.

The following notes should be observed when storing fruit.

Always try to maintain an even temperature accompanied by a dry atmosphere; 35° to 45° F., during winter.

Fruit has a tendency to shrivel when it is warmer than the surrounding air. Guard against the alternate sweating and drying of fruit, caused by variations of temperature.

Fruit usually keeps best in a subdued light, and some prefer total darkness. A fruit room should have a dry, airy situation above ground. The floor should always be kept damp. Fruit must never be stored in a wet condition; always select a fine dry day for gathering. All stored fruit should be examined periodically, and have the rotten or spotted fruits removed. Only thoroughly sound fruits free from insect attacks and disease should be stored. Early fruits are not adapted for storing as they quickly deteriorate in quality. The characteristic qualities of fruits are developed by storing.—"The Horticultural Note Book," J. C. Newsham.

THE ADVANTAGES AND RESULTS OF DRAINING SOILS ARE :—

1. Removes stagnant water.
2. Raises temperature of soil by admitting warm air and making it more productive.
3. Brings earlier harvest; fruits mature earlier.
4. Admits air into the soil for the preparation of plant food.
5. Improves the working qualities of the soil.
6. All manures act more readily, including lime.
7. Sweetens sour land, and changes organic acid to CO_2.
8. Changes FeO into Fe_2O_3, ferrous into ferric oxide.
9. Encourages heavy crops of good quality.
10. Climate is healthier and warmer.
11. The number of noxious insects in the soil is reduced.
12. Discourages the growth of obnoxious weeds.

Comparative Evaporative Power of Soils.

	Grains of Water Evaporated in 4 days.
Calcareous sand	146
Light garden mould	143
Very light turf soil	132
Arable soil	131
Heavy black turf soil	128
Fine white clay	123
Fine grey clay	123

—"The Horticultural Note Book," J. C. Newsham.

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NUMBER OF GALLONS IN CIRCULAR TANKS AND WELLS.

Diam. Feet.	3 Ft.	4 Ft.	5 Ft.	6Ft.	7 Ft.	8 Ft.	9 Ft.	10 Ft.	11 Ft.	12 Ft.
4 ..	235	313	391	469	548	626	704	783	861	939
5 ..	367	489	611	734	856	979	1,101	1,223	1,346	1,468
6 ..	528	704	881	1,057	1,233	1,409	1,585	1,762	1,938	2,114
7 ..	719	959	1,199	1,439	1,678	1,918	2,158	2,398	2,638	2,878
8 ..	939	1,253	1,566	1,879	2,192	2,506	2,819	3,132	3,445	3,759
9 ..	1,189	1,585	1,982	2,378	2,775	3,171	3,568	3,964	4,361	4,757
10 ..	1,468	1,957	2,447	2,936	3,426	3,915	4,405	4,894	5,384	5,873
11 ..	1,776	2,368	2,961	3,553	4,145	4,737	5,330	5,922	6,514	7,107
12 ..	2,114	2,812	3,524	4,229	4,933	5,638	6,343	7,048	7,753	8,458

—"The Horticultural Note Book," J. C. Newsham.

WORLD'S DAY MILK RECORD.

Professor C. B. Lane, of the United States Department of Agriculture, answered the question : " What is the world's record of the largest amount of milk given by one cow in twenty-four hours ? " as follows :—

As to the highest world's milk record of any cow for 24 hours, the Holstein cow, Shadeland Boon II., 8,892, heads the list with 122 ·5 pounds. This, however, is not official, and we must take the owner's word for it.

A later record is reported of the Holstein cow, Princess of Wayne, to be 113 ·1 pounds. This record is attested by the owner.

Another record of the same breed attested by the owner, is that of Pieterje II., 112 ·4 pounds.

The highest record that may be called official is that of Rosa Bonheur V., 106 pounds.

A record of 112 ·4 pounds is reported of the cow, Mechthilde.

Since Professor Lane presented the above, a new day's record for milk production has been made by the Holstein-Friesian cow, De Kol Creamelle, owned by Daniel W. Field, proprietor of Dutchland Farms, Montello, Mass., with an official scoring of 119 ·4 pounds of milk.—" The New Zealand Farmer, Stock and Station Journal," January, 1907.

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TO ESTIMATE VOLUME OF RAINFALL.*

Depth of inches of rainfall	x	2,323,200	cubic feet per square mile.
,, ,, ,,	x	14,478 –	millions of gallons per square mile.
,, ,, ,,	x	3,630 =	cubic feet per square acre.
,, ,, ,,	x	22,623 –	gallons per square acre.

RAINFALL.

Inches of Depth.	*Cubic feet per acre.*	*Gallons per acre.*	*Tons per acre.*
1	3,630	22,635	101 ·1
2	7,260	45,270	202 ·2
3	10,890	67,905	303 ·3
4	14,520	90,539	404 ·4
5	18,150	113,174	505 ·5
6	21,780	135,809	606 ·6
7	25,410	158,444	707 ·7
8	29,040	181,072	808 ·8
9	32,670	203,714	909 ·9
10	36,300	226,349	1,011.0
11	39,930	248,984	1,112 ·1
12	43,560	271,619	1,213 ·2

—" The Horticultural Note Book," J. C. Newsham.

* Average rainfall of Transvaal is 29 inches (approximately).—EDITOR, " T.A.J.

DIARY FOR FARM, GARDEN AND ORCHARD.

NOTES ON THE FARM.

By Alex. Holm
(General Manager, Experimental Farm, Potchefstroom).

August.

This is the last month of winter, and usually no rain falls Operations must, therefore, be confined to the care of live stock, to the advancement of preparations for the busy season of spring, and to the sowing or planting of crops assisted by irrigation.

Stock.—Upon the care of the stock during the winter months will greatly depend an early improvement in their growth and condition during the spring and summer. The poor condition during the winter months of the majority of the live stock of this country is lamentable, and often indicates bad management and want of enterprise in providing "winter keep."

Ordinary store and "dry" stock may be kept in fair condition on the veld with the assistance of good hay, mealie stalks and ensilage. All these can, with little expense, be produced on the farms of this Colony.

Much can be done to mitigate the bad effects of the cold of the winter by feeding, which will maintain the "animal heat," and which will compensate the loss in the body of the animal from exposure to cold. If shelters can be provided for the stock better use will be made of the food consumed by the animal. Want of food and exposure to cold combine to destroy the condition and the constitution of the animal.

Dairy cows and calves should have some housing during the night. Cows in milk should be given, in addition to hay, roots and ensilage, about 2 lbs. bran, 4 lbs. mealie meal and 2 lbs. pea or bean meal. If either of the latter cannot be secured at a reasonable price substitute with crushed oats.

In early districts the first lambs may be dropped this month, but lambing will not be general until September and October.

In other districts, where there is good winter veld and shelter, lambs apparently thrive best when born in March and April. These lambs should now be weaned and until the grass grows they should get some roots and a little grain, either oats or maize, or both daily.

In this country, where farms are not usually sub-divided into several grazing areas, there may be some difficulty in grazing the lambs, especially in small flocks, apart from the ewes. An endeavour should, however, be made to wean the lambs, and thereby "dry off" the ewes by keeping the lambs away from their dams for at least a fortnight. During this time the ewes should be examined daily, and if any udders are distended, relieve them by "hand" milking. By these measure the ewes will have an opportunity to improve in condition before next "tupping" season com-

mences, and a greater percentage of them will "take the ram" at the proper season than if the lambs are allowed to continue sucking. Consequently, the next crop of lambs will be dropped at the desired time, and there will be a smaller percentage of barren ewes.

Crops, etc.—On irrigated holdings the winter crops will continue to be irrigated. There is reason to believe that many crops are irrigated too frequently, and that better crops would result from better cultivations and less frequent irrigation. On well cultivated and manured land I have found that an irrigation once a month will bring an oat, barley, or wheat crop to maturity, and I would not advise irrigating more often than every three weeks. The economic use of water in irrigation is of the greatest importance. In many cases great waste takes place through imperfect preparation of the land for flooding, caused by the surface being rough and uneven, conditions brought about through bad ploughing and careless and imperfect preparation of the land by cultivating, harrowing and rolling. To obtain the greatest service from irrigation, the arrangements should be such that the water will flow over the surface as fast as possible without "washing" the soil. Thereby, the crop obtains sufficient moisture, less impoverishment takes place by soakage through the sub-soil, the soil does not become water-logged, and greatest use is made of the available supply.

Considerable growth usually takes place in winter crops this month. Oats, barley and wheat should be harrowed to loosen the soil around the roots and to conserve the moisture. If the land is rough it should be rolled when dry, especially if machinery is used in harvesting the crop.

The first crop of potatoes is planted this month. In most districts the middle of the month will be early enough for planting. If planted before this there is some risk of the young shoots being destroyed by frost. Some notes on the planting and manuring of potatoes appear in the "Journal" No. 13, October, 1905, page 214.

Of the early varieties, "Early Rose" probably suits most soils best. It gives a larger yield than other early varieties, though it has the fault of being a "bad" keeper, especially in transit. Other varieties which are earlier than "Early Rose" are "Sir John Llewellyn," "Duke of York," "White Hebron," and "Early Puritan." The former has proved to be a small cropper; "Duke of York," unfortunately, has yellow flesh, and is apt to grow a large proportion of small potatoes in some soils. The two last-named varieties are potatoes of good quality but the crop is rather small.

Of medium early varieties, "Sutton's Flourball" can be highly recommended. It grows a good marketable sample of tubers, and gives a good yield. Moreover, it is a good keeper. It appears to be well suited to this climate, being hardy and vigorous in growth.

Of late varieties "Scottish Triumph," "Up-to-date," "Five Towers," and "Diamond," have proved to be very heavy croppers in several trials.

"Fidler's Record" (an early variety), "African Red" and "Langworthy" have given excellent results in this year's trials. The once famous varieties, "Northern Star," "Eldorado," and "Sutton's Discovery," which recently caused a sensation in the potato world have, after several trials, been found unsatisfactory.

If the land has been irrigated before planting takes place, there should be sufficient moisture in the soil to promote the growth until the crop is far enough advanced to be hand and horse hoed and ridged up. Let irrigation follow the ridging plough. By this means the crop will be kept growing, and there will be a saving in the amount of water required. This irrigation will probably take place in October, after which the usual spring rains should assist the growth of the crop, and, at the most, only one more irrigation should be required to mature the crop.

SEPTEMBER.

Spring now dawns upon the farmers' year, and general activity is, or should be, seen all round. Upon the preparations made during the spring for the summer's crop, and the care of the off-spring born at this season of the year will much depend the results of the year's work.

Stock.—All kinds of farm live stock will now be giving birth to their young. Lambing will be common in many districts, though, too often, ewes are permitted to lamb at irregular periods during the year. This is brought about by the rams running continuously with the ewes, and is a practice which is not recommended for the good management of a flock. Lambs should be dropped in spring or autumn according to the nature of the locality, and the time of their birth can be regulated by calculating five calendar months as the gestation period, *i.e.*, that period during which an animal carries its young.

Losses among ewes and lambs from want of nourishment are too frequent in the spring months. The flockowner could with a little enterprise and foresight largely prevent this. Silage and a little mealies fed in addition to the pasture provide the remedy. Exact data are not yet available, but it is reckoned that 3 to 4 lbs. silage per ewe per day should be fed in addition to the pasture with or without the addition of ½ lb. maize or oats, according to the condition of the sheep and other circumstances.

The cost of winter feeding a flock of 1,000 ewes may be calculated as follows :—

One thousand head at 4 lbs. silage per day equals 2 tons per day for a period of 10 weeks or 70 days equals 140 tons—140 tons of silage can be grown on 10 to 14 acres (or approximately 5 to 7 morgen). The cost of growing and making the silage may be taken at 10s. per ton. The cost of 140 tons at 10s. is therefore £70, and the cost per ewe for 10 weeks feeding is 1s. 4¾d. Assuming that in addition it is necessary to feed a little grain for the first month after lambing, 1,000 ewes would consume 500 lbs. of mealies daily, which at 8s. per bag would cost £1 per day or 7¼d. per ewe for the period of one month.

Such a practice of winter feeding at a comparatively low cost is surely worth the attention of sheep-breeders, in order that the fatalities among ewes and lambs may be reduced to a minimum, and that the alternative of trekking, attended by the risks of disease, expense and losses, may be abandoned.

In difficult cases of lambing, a stimulant and sedative, such as chlorodyne, should be given to the ewe, and the vagina syringed with a

weak solution of permanganate of potash to which should be added a few drops of laudanum. This will often prevent inflammation setting in, and losses in ewes will be reduced. When deaths take place and lambs have to be transferred to foster mothers, skin the dead lamb and wrap the skin round the lamb which is to be put with another ewe, and keep both ewe and lamb confined in close quarters for a few days. The transfer may also be assisted by rubbing the skin with milk from the ewe, also by moistening the nose of the ewe and the skin of the lamb with paraffin.

In order to prevent losses among young pigs through being overlain by the sow, rails should be fixed round the sty, 9 inches from the wall and 9 inches high from the ground. The young pigs will soon find their way to this safe situation where their dam cannot disturb them. A sow suckling her offspring should receive good nourishing food, say, bran or barley meal mixed with mealie meal, and also get plenty of green stuff.

Crops.—Ploughing should be pushed forward in preparation for the sowing season. If new land has to be cropped this summer, and it has not already been turned over, break up the surface as well as possible, so that the first rains will penetrate, when the land can be cross-ploughed well, and the crop be sown at the proper time.

Many farmers fall into the habit and error of being too late in planting their crops, with the inevitable result of disappointment and failure.

A good plough is a great boon to the cultivator, and, though the writer does not wish to advertise any particular manufacturer's wares, he would mention three double-furrow ploughs as being serviceable implements, each suitable for particular classes of work, viz., the "Flying Dutchman," the "Columbia," and the "Double Furrow Chuker J."

Little seeding is done this month. It is too early for summer crops and unseasonable for irrigated crops, with perhaps, the exception of lucerne, which may now be sown, provided plenty of water is available. Avoid sowing lucerne on foul land, and drill it in rows about 12 ins. in preference to broadcasting. From 12 to 16 lbs. per acre of good seed will be sufficient. In any case, observe that the seed is not buried too deep; the depth should not exceed ½ to ¾ inch, and germination takes place satisfactorily with only a slight covering of soil. Therefore, prepare an even and firm seed-bed. Secure the best seed available. The importance of obtaining sound seed of the best varieties cannot be overestimated, and will repay the increased cost many times over. The cost of cultivating an inferior is no less than that of a good crop, in fact, it sometimes costs more, as land quickly becomes polluted with weeds when the crop does not succeed. Unfortunately, little reliable data have been available regarding the most suitable varieties of crops, but this want is being rapidly overcome by the work of investigators and by the keener observations of farmers themselves.

OCTOBER.

Stock.—The calving season will now have begun, and the young grass will stimulate the flow of milk. Spring-born calves are recommended, as

they are old enough to thrive on the pasture before winter sets in, and are stronger to withstand the cold and more scant fare of the winter season than calves born during the summer months. If the milk be required for dairying purposes, the calf may be reared by hand. Begin by feeding three times a day for a week, and twice a day after that. When two or three months old. the calf may be given a little crushed oats and linseed, with bran or mealie meal, but do not give bulky foods until the calf is at least four months old.

The lambing season wlll now be closing in those districts where spring lambs are the rule. The lambs should have their tales cut, and the ram lambs, except those retained for stud purposes, should be castrated when they are from two to four weeks old.

Shearing will now be commencing after lambing has finished. The belly, tail and leg pieces should be kept separate and packed in a different bale from the rest of the fleece. The wool should also be graded by separating the long staple fleeces from the short, and by classing the fleeces according to their lustre, fineness and quality in general. The sheep may be dipped at this season after shearing, or in the beginning of autumn. If dipping were regularly practised, and if all fresh purchases of sheep were dipped before being put into the flock, scab, the scourge of so many flocks, would soon be a thing of the past. The remedy is so simple and effective that one wonders why scab is so prevalent. The cost of erection of a dipping tank and the dipping itself, is not so heavy an expenditure but that it is within the means of everyone who has capital sufficient to own a small flock.

Crops.—Seeding and cultivation in preparation thereof will occupy the farm hands. Very often crops are sown on a badly prepared seed bed, especially on "new" land, where the ploughing is imperfect and the surface uneven and cloddy. The result is that, when a drought sets in, the crops suffer and the climate receives more blame than should be laid upon it.

Kaffir corn should now be sown and, in districts where early rainfall takes place, the main crop of maize should be sown. In each case drilling in rows is the best practice. The seed is then deposited at the requisite depth and properly healed in; thus better germination is secured and the crop is more easily kept clear of weeds. Kaffir corn may be sown with the ordinary "mealie planter," by using special discs made for that purpose. The rows should be from 2 ft. to 2 ft. 6in. apart, and five to six pounds of seed will sow one acre.

The sowing or planting of maize begins this month with late varieties, but early and medium early varieties may be sown during the next two months.

Maize is often planted this month in anticipation of rain. In that case it should be planted three or four inches deep, so that if only a slight rain falls, germination will not take place and the risk of the young shoot dying from insufficient moisture will be avoided. The best method of planting maize in this Colony is now a subject of attention. Up to the present, our experiments indicate that late or strong growing varieties should be planted at distances of 3 ft. 6 in. between the rows, and 1 ft. 6 in.

in the row; varieties which are medium in their maturity, and which are less robust in their growth, should be planted at three feet between the rows and about one foot in the row. Early varieties, most of which are dwarf in habit of growth, can be grown at 2 ft. 6in. between the rows, and about one foot in the rows. From 8 to 12 lbs. of seed will be required to plant each acre according to size of seed and distances apart of planting.

The following varieties, many of which have recently been introduced into this Colony, can be highly recommended after several trials.—

For High Veld.—Eureka Field Corn, Champion White Pearl, Extra Early Huron Dent, Wood's Northern White Dent, King of the Earlies, Iowa Silver Mine, Chester County Mammoth Field Corn, Hundred Day Bristol, Early Star Leaming, White Cango, Longfellow Flint, White Cap Dent, Yellow Flint, Ninety Day.

For Middle and Lower Veld.—Virginian Horsetooth, Yellow Horsetooth, Hickory Horsetooth, Hickory King, Improved Early Horsetooth, Golden King, Brazilian Flour Corn, Transvaal Yellow, Yellow Hogan.

Pumpkins may be planted this month and in November. If grown in the mealie crop they, no doubt, benefit from the shade afforded, but they take a lot of moisture from the soil and they hinder the operation of cultivating the mealie crop. They can be successfully grown by dibbling the seeds in rows six feet apart and six feet in each row. This system facilitates the keeping of the land free from weeds.

Early crops of barley, oats and wheat will be ready for harvesting at the end of the month.

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THE GARDEN.

By J M. Maxwell-Lyte, F.R.H.S., Assistant Horticulturist, Government Experimental Orchard, Potchefstroom

August.

Vegetables.—This is the month (springtime) in which practically all kinds of seeds can be sown, with the exception of cauliflower.

Make a sowing of potatoes. Plant out strawberry runners in rows two feet apart and 18 inches in the row.

Flowers.—All kinds of seeds can now be sown. Plant roses (see notes for July—"Journal" No. 19, page 761).

Carnations.—No garden is complete without this beautiful flower, which can be grown either as a border or in beds. It will always repay one to get the best seed or layers, which should contain the Self, the Bizarre, the Flake and the Picotee.

Propagation.—By Layers.—This is the simplest way of propagating denude all the lower leaves of the branches which form the layers, and make an incision on the under side below joint, and carry this upwards through joint, then peg down this layer and cover it with at least two inches of soil. Later on when this layer has rooted, it can be transplanted.

By Cuttings.—Select the sturdiest plants and discard any weaklings. Pull from the plants the required cuttings with a downward movement; by this method there will be a toe at the base of the cutting. Propagation by this method is slow and unreliable, and should only be resorted to in the case of rare varieties, which cannot be conveniently layered.

By Seed.—Prepare your seed bed with care, and see that the soil is well sifted, the bed should be enriched with well rotted manure, and should contain a good percentage of fine sand. Sow the seed thinly but evenly, and cover it with sand or fine soil. Protect the young plants from the two extremes of hot sunshine by day and the cold by night. When the young plants are two to three inches in height they can be planted out into permanent beds. Should specimen blooms be desired, only one bud should be allowed to remain on each terminal, selecting the best developed bud in each case.

SEPTEMBER.

VEGETABLES.—Sow pumpkins, vegetable marrows, cucumbers, beans, water-melons, musk-melons, sweet potatoes and sweet maize.

Pumpkins and Vegetable Marrows.—Sow in rows six feet apart, and the seed two feet in the rows. Keep the soil moist and when the vines are in blossom, water freely.

Cucumbers.—Treat same as pumpkins.

French Beans.—Sow in drills two feet apart and two inches deep, leaving six inches between the seeds. Shelter young plants from the cold winds.

Melons.—The soil for melons should be a good, rather strong, loam, and with just sufficient manure to give the plants a start. The seed should be sown in hills five to six feet apart, placing ten to a dozen seeds in each, and when the plants have two to three rough leaves, thin them out to three plants. As their growth becomes too luxuriant, pinch off the leading shoots. When the fruit is half grown there is no need for further irrigation.

Sweet Maize.—This should be sown this month and the two following months for succession, in drill three feet apart and the plants one foot apart. The cobs should be gathered as soon as the grains are fully formed, and should not be allowed to ripen; a good top dressing during its growth will be beneficial.

FLOWERS.—In this month all kinds of flower seeds may be sown.

OCTOBER.

VEGETABLES.—In this month all kinds of seeds may be sown; asparagus, broad beans, French beans, runner beans, beet, cabbage, carrot, celery, cucumber, mustard, cress, egg plant, endive, herbs, leeks, lettuce, melons, onions, parsley, peas, parsnips, rhubarb, radish, spinach, tomatoes, turnip, vegetable marrow, etc., etc.

Asparagus.—The beds prepared during May should be ready for sowing now. Sow in rows 18 inches apart, and when large enough thin out to nine inches. Keep your beds clear of weeds to prevent the young seedlings from getting choked. Give an occasional dressing of salt.

Broad Beans.—See May notes. ("Journal" No. 19, page 762.)

French Beans.—Sow in a warm and sheltered part of your garden, sow in drills two feet apart and two inches in depth, and four inches between the seed. Keep the ground well mulched and apply water frequently if the weather is dry.

Runner Beans.—Same as French beans, but plant four feet apart. Stakes from six to seven feet long should be firmly planted in the rows to carry the runners.

Beets, Carrots and Cabbage.—See May notes.

Celery—Sow in a shallow box containing rich soil and place in a warm aspect, when the plants are large enough to handle, they should be pricked into other boxes and continued in the warmth until well established, then hardened off till ready to be planted out in a bed or rich soil six inches apart, preparatory to planting in trenches.

Cucumbers.- Same as melons.

Mustard and Cress.—Sow thickly and barely cover the seeds, and make fortnightly sowings in limited quantities to ensure succession.

Egg Plant.—Sow in bed and plant out from 18 inches to two feet apart. Manure and water well.

Peas.—To maintain a continuous succession, sow as soon as the previous crop appears above ground. Sow in rows from 2½ to 3 feet, at one inch apart for dwarf varieties, and for taller sorts in rows from four to five feet apart with the seed three to four inches apart.

Rhubarb.—The seed can be sown in boxes or tins, and when planted out, the plants should stand three to four feet apart, and the crowns covered two inches. No stalks should be gathered the first year from the seedlings, but should be left to strengthen the plants.

Tomatoes.—These are easily grown, providing space and manure are not stinted. Sow early in the spring to secure an early crop; when planted out in the open three feet apart each way, stake and top the plants at the flower.

Vegetable Marrows.—See melons.

Endive, Leek, Lettuce, Onion, Parsnip, Parsley, Radish, Spinach and Turnips.—See May notes.

Flowers.—Seeds of every kind may be sown at this season, such as aster, balsam, candytuft, chrysanthemum, carnation, cockscomb, coreopsis, dahlia, digitalis, godetia, hibiscus, fuschia, larkspur, linum, mignonette, nasturtium, pansy, phlox, violets, etc.

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THE ORCHARD.

By R. A. Davis, Horticulturist.

August.

Deciduous Fruit Trees.—It is customary in most fruit growing countries to expect that all winter work, such as planting, pruning, spraying, etc., should be finished by the end of this month. This is equally applicable

here and the only work which it is excusable to leave over is the pruning of peach and nectarine trees. This operation may be performed when the trees are in bloom with the advantage that one can see just where to expect fruit and trim the trees accordingly. In the colder parts of the high veld, where vegetation is later in responding to usual spring influences, one may put off all pruning until this month, but it is well to be a little ahead of work rather than behind hand so that August pruning should only be looked upon as happening occasionally Planting of fruit trees may still take place, in fact this is quite a good month for this work on the high veld. The advantage of course is that one has less watering to attend to than when July is selected as the planting month.

Citrus.—The ingathering of the crop of oranges will keep growers busy during this month. Care should be taken to destroy all fruit which appears to be infested with "Fruit Fly" or the "Orange Codling Moth." Fortunately these pests are not very numerous in this Colony, but it should be borne in mind that they increase with great rapidity and every effort should be made to destroy them where found. The question of the disposal of an orange crop is one of great interest to farmers who produce this fruit In the early and middle part of the season prices are apt to rule low, as October and November approach figures improve, and in December rise to as much as 20s. per 100. The risk in allowing oranges to remain so long on the trees is great and it is questionable whether a cash sale for the whole crop in August is not better to entertain even at about 5s. or 6s. per 100 than to wait until later to have a large percentage of the fruit lost by high winds, pilfering, etc.

SEPTEMBER.

Deciduous.—All winter work having been completed, the orchard should now be looking at its best if it can be said that such a thing is possible without leaves on the trees. However, these will soon appear if in some cases this has not already happened. All the trees of July and August planting should be watched carefully and labels possibly left on at planting time removed. If this is not done the wire or string by which they are attached is liable to be overgrown by the bark causing oftentimes the loss of the tree later on. The selection of the shoots which it is intended to leave to form the future main limbs of the tree should be studied and so arranged that some three or four only are allowed to remain and these should be permitted to grow so as to secure branches which will afterwards balance the tree properly. One may for instance, be left in each direction north, south, east, and west, and a space of a couple of inches should intervene between the starting point of each from the main stem. If all are allowed to branch out at one spot—that spot in a few years' time becomes the weak place in the tree. A large quantity of fruit on each branch makes a considerable strain on the spot from which the limb starts and if these originate all on one place, the result is oftentimes that one or more limbs will break down, snapping off near the trunk. If the main limbs are placed properly, this will not occur, no matter how great the burden of fruit may be, the tendency then is for the end of the branch to sag over. This state of affairs demands props sometimes, and a break without the

use of these may occur, but the weak point is then in about the middle of the branch, and it is not necessarily lost, as would be the case if all the limbs started from almost the same spot. Fertilizers may be given where needed. In the Transvaal this is rarely the case, excepting where a tree has produced continuous heavy crops of fruit. If this is allowed to continue the result is a small, poor, unmarketable product. Commercial fertilizers—those containing a good amount of potash and phosphates—are the best to use. Nitrogenous manures are of lesser value here, as our conditions of growth are so very favourable—the fault, in fact, is that fruit trees are inclined to go too much to wood at the expense of fruit producing qualities. I have rarely had occasion to recommend nitrogen as a fertilizer during the five years I have spent here.

Citrus.—The best period for attending to the needs of Citrus trees in all such matters as scale and disease, either of root or branch, is that which comes between the picking of the fruit and the opening of the blossoms. By using that time for remedial measures, less damage is liable to be done to the trees than at any other. Fumigation for red scale, however, may be left until the fruit is the size of a marble or even larger There is every evidence that the practice of fumigation is on the increase in this Colony, and where red scale is present it may be as well to apply to the Government Entomologist, who will supply full particulars as to how the operation should be conducted Roots of orange trees may be opened up with advantage after the fruit is off, and examination made for signs of collar rot; the treatment of this disease has so often been described in this "Journal," that it is hardly necessary to republish it now The trouble is, however, so serious that it is incumbent on all who wish to own really healthy trees not to be caught napping, and an annual inspection is the least that can be asked for in order to obviate this

OCTOBER

Trees that have been recently planted must be well watered, although not too much water must be given, as this would be as fatal to the young trees as too little. Where early peach, apricot, and nectarine trees are thickly clustered, they should be thinned if good fruit is expected. Regarding deciduous fruit trees, all young trees which have been planted out during the past season must be carefully watched, and all buds appearing below those which have been selected to form the head of the tree should be rubbed as they come out. These trees should be watered occasionally, and after each application, the ground stirred with a hoe or spade, as this serves to retain the moisture in the ground, making frequent applications unnecessary. The same applies to citrus fruits, as three-fourths of the diseases of orange trees in the Transvaal are due to too abundant water.

Plate CCXXXI

A Pioneer of Veterinary Science in South Africa.

The late Dr Hutcheon Director of Agriculture Department of Agriculture Cape Colony

EDITORIAL NOTES.

A Pioneer of Veterinary Science in South Africa.

It is with a keen sense of sadness that we have to record in our present issue the death of Dr. Hutcheon, Director of Agriculture, Cape Colony, at his residence at Maitland, on the 14th of last May. As one of the pioneers of Veterinary Surgery in South Africa, Dr. Hutcheon filled the position of Chief Veterinary Surgeon of Cape Colony for nearly twenty-five years before accepting the post of Director of Agriculture; and by the work which he did during this period won the respect and confidence of the farming community throughout South Africa. Of his scientific attainments and of the value of the work done by him in the field of South African Veterinary Science, it is impossible to speak too highly; but, apart from his professional attainments, Dr. Hutcheon owed much of his popularity to the peculiar sympathy and consideration which he invariably extended to all who appealed to him for assistance and advice. Moreover, it is to be feared that his unselfish devotion to the ever-increasing duties imposed upon him during the past few years indirectly contributed to his premature demise at a time when his many friends were looking forward to seeing him retire in the enjoyment of a well-earned pension.

* * * *

Mr. Duncan Hutcheon was born near Peterhead, in Scotland, in 1842, and received his early education at the parish school of Old Meldrum, Mollison's Academy, Aberdeen, and at some privately conducted evening classes. According to some biographical details given in "Men of the Times," he began life as an agricultural assistant, and it was in this capacity that he obtained his first experience in the care of livestock. In 1868, he joined the Dick Veterinary College, Edinburgh, where he soon distinguished himself, obtaining the Dick Bursary of £30 per year for three years at the close of the first session; the conditions attached being that for the whole period he should occupy the position of assistant to the principal, Mr. H. Williams. In 1871, he obtained the diploma of the Highland Agricultural Society, also that of the Royal College of Veterinary Surgeons, passing with distinction and winning the silver medal for anatomy, physiology, chemistry, *materia medica,* and trippopathology, and the Highland Society's medal for the "best general examination."

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On leaving college he practised for a time with Messrs. Pollock & Sons, in Edinburgh, and in 1872, he conducted a practice in Limerick for Mr. O'Connor. In the following year he joined Mr. Arthur Santy as assistant, at Castle Meadow, Norwich, then one of the largest practices in the eastern counties. After two years' work there he was appointed veterinary surgeon of the Liverpool Omnibus and Tramway Co., where he remained until

leaving to take up a position as Colonial Veterinary Surgeon to the Cape Government, on March 2, 188[illegible]

* * * *

His new sphere of activities gave ample scope for original research, and he had only been in South Africa a year when the outbreak of pleuro-pneumonia in Angora goats called for his special attention. This disease broke out in 1881, and proved most destructive, and had it not been for Dr. Hutcheon's measures in carrying out preventive inoculation on an extensive scale, in conjunction with strict quarantine regulations, the whole Angora goat industry in South Africa would have been imperilled. He received the thanks of Parliament for his work, together with a special bonus, and was presented by the Angora farmers with a gold watch and chain, a large gold cup, and a binocular microscope.

* * * *

South Africa is particularly rich in animal diseases, every species of domestic animal seeming to have one or more peculiarly adapted for its destruction. The whole of Dr. Hutcheon's career has, in fact, been one long struggle against the relentless attacks of disease upon the animal life of the country. In his address as President of the Physiological Section of the British Association, in 1905, Colonel D. Bruce, M.B., F.R.S., C.B., observed: "It is to Mr. Hutcheon that South Africa owes its knowledge of many stock diseases. For the last 25 years he has laboured with the utmost earnestness in Cape Colony, often under trying conditions, and his description of the various diseases formed the basis of all the modern work done on the subject." This is no exaggeration. It errs, if anything, on the opposite side. It was Dr. Hutcheon who first described the sheep disease, commonly known as "blue-tongue," the disease of heartwater in cattle, goats, and sheep, and a score of other plagues and pests. In 1883–4 he was found carrying on the campaign against redwater in cattle, and it was under his advice that Mr. Spreuill was able to prove that a preventive serum could be prepared capable of immunising sheep against catarrhal fever. To enumerate the experiments, many of them highly successful, which he carried out with a view to checking the spread of animal diseases would be out of place in these columns, but in the domain of veterinary science he has established a reputation which is not likely soon to perish.

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Perhaps the most notable of the many campaigns he had to wage on behalf of the Colony was that against the terrible rinderpest epidemic which broke out in 1896 and caused fearful losses to the stock farmers of South Africa. Dr. Hutcheon directed and controlled the fight, showing inexhaustible energy, traversing the country from end to end, establishing a strict system of quarantine, and all the while supervising the laboratory experiments which were being made to counteract the disease. His labours in those days were indeed almost superhuman. Eventually he adopted the stamping-out process, and this undoubtedly checked the

spread of the disease, though it was not until Koch's discovery of the bile method of treatment that the disease was finally eradicated. It is to Koch, Kolle, and Turner that we owe the fact that rinderpest has now lost its terrors, but Hutcheon's self-denying labours are not likely to be forgotten when farmers talk among themselves of the bad old days when rinderpest was abroad in the land.

Dr. Hutcheon has, during his professional career, been a prolific writer of valuable articles on stock-breeding, stock diseases, and kindred subjects. In 1902, his services to the veterinary profession were recognised by the Royal College of Veterinary Surgeons, which elected him as Honorary Associate. On August 1st, 1905, he was appointed Acting Director of Agriculture, the appointment being confirmed on July 1st, 1906. This post was established as the result of the re-organisation of the Department of Agriculture, the office of Under Secretary for Agriculture being abolished under the new scheme. Dr. Hutcheon's appointment was hailed with general satisfaction throughout the Colony, and there can be little doubt the result has been increased efficiency throughout the department. and a greater concentration of energy. Dr. Hutcheon's personal labours during the past 18 months have been extremely heavy. Quite recently he was up at Vryburg investigating an outbreak of lamziekte. The passage last year of the Animal Diseases Act Amendment Bill. which was very largely framed upon his advice, involving increased labours, and the comparatively recent agricultural developments in various directions had all been receiving his personal attention. As we mentioned above, he has always been an enthusiast on the question of improving the breed of stock in this country, and in his last report he brought forward proposals for fostering the horsebreeding industry and assisting the farmers to obtain suitable stallions at a moderate price. The dairy industry, too, was a subject to which for some years he directed special attention, and his pamphlets on the subject have been of great value to the dairy farmers of the Colony. The destruction of vermin, the eradication of prickly pear, the preservation of game, viticulture and wine-making, the administration of the Scab Act, and the supervision of the experimental agricultural stations are some of the varied activities which Dr. Hutcheon was called upon to direct, while, of course, he retained his very important duties as Chief Veterinary Surgeon for the Colony. In his multifarious capacities, Dr. Hutcheon was necessarily brought into close and frequent relations with the farmers of the Colony, and there are few men in this country who have enjoyed wider respect or affection. He was a very slave to duty. He was always to be found at his office at nine o'clock in the morning, and frequently remained as late as 10 at night. As head of his department, he had a wonderful capacity for encouraging his colleagues and juniors to work their hardest, and none will more deeply regret his demise than his associates in the Agricultural Department.

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Apart from his official activities, Dr. Hutcheon was well known and deservedly popular in social circles in Capetown. It was only a week or

two before his death he presided at the Aberdeen, Banff, and Kincardine Society's annual meeting. As President, he took the keenest interest in everything connected with the society, and his sympathy and financial help were never denied. At the same time he was a favourite at the meeting of kindred Scottish and English societies, and had no small reputation as a ready and witty speaker. He took a deep interest in the public affairs of Maitland, and it was largely through his instrumentality that the Presbyterian Church there, of which he was an elder, was built. He was a member of the Civil Service Club, Capetown, and of most of the South African clubs. Dr. Hutcheon was twice married, and leaves a daughter by his first wife and two sons and a daughter by his second wife, who survives him, and for whom in their bereavement, the deepest sympathy will be felt.*

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Vacation Courses in Agricultural Science.

A gratifying sign of the progress of agricultural education in South Africa is to be seen in the Vacation Courses in Agriculture which have been established by the Rhodes University College. This college, assisted by the officers of the various Agricultural Departments in South Africa and others, offers to farmers and farmers' sons a series of vacation courses in agriculture, including the following :—

Horse-sickness, Veterinary Science and Diseases of Stock, Breeding of Merinoes and Angoras, Agricultural Chemistry, Agricultural Geology, Farm Irrigation and Dam Construction, Law of Water and Water Rights, Plant Diseases, the Ostrich and its Feathers, Economic Entomology, Insects and Insect Control, Mechanics and Meteorology, Farm Surveying and Levelling.

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The courses will be held in Grahamstown for the three weeks beginning June 24th and ending July 13th, 1907, and will be of such a character as not to presume any previous theoretical knowledge of the subjects. They will be of as practical a nature as possible, and are designed to benefit those actually engaged in agriculture. The courses will consist of lectures illustrated and followed by practical demonstrations, consisting of examination of specimens, dissections, and microscopic preparations. Visits will be arranged to neighbouring fruit and stock farms and local industries. Opportunity will be given for questions and discussions. The fee for all the courses will be £2 2s., and £1 1s. for one week or for any single course. Fees are payable to the Registrar on application for admission to the course.

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The Cape Government Railway is so far in sympathy with the scheme that arrangements have been made whereby students attending the courses can obtain return fares at the rate of half ordinary fares. Further, the

* "Cape Times," May 22, 1907.

authorities of St. Andrew's College have undertaken to board and lodge students attending the courses at the rate of 4s. 6d. per day. Altogether, the scheme is an excellent one, and places within the reach of the farmers an opportunity to gain at least some rudimentary knowledge of the first principles of farming on a scientific basis. The movement is on the right lines, and indicates the wise determination of the Cape Colony to give more attention to the study of modern agriculture.

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The lecturer on Horse-Sickness will be Dr. Arnold Theiler, Government Bacteriologist to the Transvaal Department of Agriculture. Other lecturers will be Mr. W. Robertson, M.R.C.V.S., F.R.S.E., Director of the Veterinary Laboratory. Grahamstown; Professor G. E. Cory, M.A., F.C.S., Professor of Chemistry and Metallurgy, Rhodes University College; Professor E. H. L. Schwarz, A.R.C.S., F.G.S., Professor of Geology, Rhodes University College; Mr. W. Ingham, A.M.I.C.E., M.I.M.E., Hydraulic Engineer, Port Elizabeth Municipality; Professor W. A. MacFadyen, M.A., LL.D., Professor of Law, Rhodes University College; Professor S. Schonland, M.A., Ph.D., Professor of Botany, Rhodes University College; Mr. W. R. Dewar, Eastern Province Entomologist; Professor A. Ogg, M.A., B.Sc., Ph.D., Professor of Physics and Applied Mathematics, Rhodes University College; Professor J. E. Duerden, M.Sc., Ph.D., A.R.C.Sc., Professor of Zoology, Rhodes University College; Mr. C. J. Lee, President of Agricultural Union; Mr. D. Williams, B.Sc., Assistant Lecturer in Mathematics, Rhodes University College; Mr. T. T. Hoole, and others.

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Short winter courses for farmers' sons and others interested are annually given at all the great American Agricultural Colleges, and are attended by hundreds of earnest young men. Our own students should not fail to avail themselves of this admirable method of obtaining sound theoretical and practical instruction in agriculture and the allied sciences, and so strengthen the hands of the colleges and the Governments throughout South Africa in their effort to enlarge the scope of University instruction.

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The Work of the Tobacco Division.

Mr. J. van Leenhoff, the Government Tobacco Expert, will be pleased to hear from the farmers resident in the remoter parts of the Colony and to give any assistance which they may require. In a word, the policy of the Tobacco Division is to obtain reliable data by carefully conducted experiments upon all points in connection with the production of a good saleable leaf, and to disseminate such information amongst the farmers of the Colony.

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Tobacco Experiment Stations have been established at Rustenburg, Barberton, and Pretoria. Many different kinds of tobacco seed have been sown at these stations, as well as on a few private farms, where, through

the courtesy of farmers, the Division has been permitted to conduct various experiments. The plants selected for seed were carefully bagged, the seed harvested and classified, and is now ready for testing next season. Seed from the strongest and healthiest plants was alone chosen, and due regard in the selection of the plants was taken to retain only those showing the special characteristics of the particular kind of tobacco they represent. Too much attention cannot be paid to this work of seed selection. For, by the careful selection of plants for seed, year by year, the tobacco crop is greatly improved, and the grower should not rest content unless he can see a distinct advance in the quality of his crop.

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Buildings have been erected on the Experimental Stations at Rustenburg and Barberton, consisting of curing and fermenting sheds, where the tobacco will be treated by modern methods of curing and fermenting. No opportunity should be lost by our farmers to make themselves thoroughly acquainted with the latest methods of handling tobacco from the *seed-bed* to the *warehouse*. Moreover, the question of creating a market for Transvaal tobacco is one which is being thoroughly investigated, and it is more than likely that at an early date a system of co-operation under the control of the Government, in conjunction with the farmers, will be inaugurated.

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Transvaal Tobacco at Recent Exhibitions.

It is gratifying to be able to record that the exhibits of Transvaal tobacco at the Exhibitions held in London Amsterdam, and New Zealand attracted a good deal of attention, and increased business in these markets is likely to result. Messrs. F. H. Hartley & Son were awarded, at the Exhibition held at Christchurch, New Zealand, a silver medal diploma for their cut tobacco and one for manufactured leaf, being the only medals given for those classes of tobaccos. We understand that as there were but few exhibits at the London Exhibition, no medals were awarded. The official report of the committee has not yet been received, but according to private advices, the judges were well pleased with many of the samples of leaf tobacco displayed. Although it may be difficult at present for our manufactured products to compete in England with those from other countries, there is no reason why they should not become popular in some of the Colonies, and the possibilities of a large trade in "leaf" appear to be hopeful. Planters of good leaf should, therefore, lose no time in ascertaining the exact classes required in the different markets.

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The Work of the Division of Chemistry.

The Division of Chemistry has recently been engaged in the investigation of the chemical character of various fodder crops which might with advantage be used to supplement the usual rations of horses and mules in this country. Interesting results with reference to the feeding properties of many native and introduced fodder crops are being obtained, while particular importance is being paid to determinations of the relative proportions of lime and phos-

phoric acid present in the ash of the various plants, in view of the relation which this has upon bone formation in animals.

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Another investigation which has involved a considerable amount of labour is in connection with the nature and methods of prevention of the disease known as "*Bitter Pit*" in apples. This disease, which is causing much damage to apples in Cape Colony, has appeared also in the Transvaal. According to the Plant Pathologist, Mr. I. B. Pole Evans, it is not caused by a micro-organism, no fungus, bacterium, or other causal agent having been found to be associated with the disease, and it must, therefore, be attributed to a physiological weakness of the tissues of the fruit.

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Analyses of diseased and healthy apples and of varieties susceptible and immune to the disease are being made, while field experiments on a large scale are being conducted with a view of discovering a successful method of combating the trouble. Already some very promising results have been obtained, and it is confidently hoped that next season's crop will afford results of great practical importance. It has been demonstrated that certain lines of treatment are favourable to the production of the disease, while others produce a decided diminution in the proportion of "pitted" fruit. The experiments, therefore, so far, indicate what treatment is to be avoided, as well as that which is to be recommended, and an exhaustive paper on this subject, in conjunction with the Pathologist and Mycologist, will be published later on.

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South African Products Exhibition, London, 1907.

The official report of the Exhibition Committee has not yet been received, so that we are unable to give, at present, a detailed reference to the exhibits forwarded by this Colony, but it is expected that full information will be in hand in time for publication in the October issue of the "Journal." In the meantime, it may be said that the Exhibitions at London and Amsterdam were a great success, both from an educational and financial point of view. It is hoped there will be a credit balance after paying all the expenses of both Exhibitions and the cost of the London office up to the date of writing.

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As a result of the Exhibition an enquiry has lately been received for the flat trays made and used by natives for winnowing grain. It was pointed out that these would be useful for the garden or greenhouse in the gathering of fruit. From enquiries made, it is evident, however, that the present price is prohibitive. Those prices are maintained by the fact that a ready sale for the baskets already exists in those districts where the material from which they are made is not found. But it has been suggested that strips of the "malala palm" might be substituted for the material now used. Possibly, in the near future these native baskets

may be used in South Africa more extensively than at the present moment, more particularly if the actual needs of the householder are to be studied. Osiers would, no doubt, grow well in many parts of the country, and could be used in the development of an important basketware industry, which might afford steady employment to both white and native workers.

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Those of our readers who are interested in the extension of local industries will be glad to learn that Messrs. T. W. Beckett & Co. of Pretoria have purchased a considerable supply of mixed cotton from the Zoutpansberg District for the purpose of ascertaining if it can be used in the upholstering trade they are now carrying on.

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The Problem of Pure Seed for the Farmer.

The Assistant of Seed and Plant Experiments, Mr. H. Godfrey Mundy, informs us that, as the result of the increasing desire on the part of farmers to lay down large areas under certain seeds recommended by the Department, there is great need of some arrangement by which the farmer can be supplied with the required quantity of seed at a minimum cost. At present there are few seed merchants in South Africa to whom the farmers can be referred, because, naturally, they are very careful to stock only the common seeds of the country.

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The policy of the Department of Agriculture is to issue small quantities of seeds for co-operative experiments. During the past month the Division of Botany has received applications for at least 500 lbs. of seed of the two varieties "Golden Millet" and "Californian Green Moha." The demand, however, still continues, and each week further applications for various seeds to be supplied in bulk are received. To us it would appear that there are two alternatives, either the merchants must take up the matter and supply good pure seed at reasonable rates or the Seed Vote of the Department must be materially increased. A co-operative Seed Bureau controlled by Government would possibly prove the most satisfactory solution of this whole problem.

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The whole problem of seed control, analysis, and distribution is so important that a note of what has been done in the progressive country of Sweden may be of interest:

In 1869 the first establishment for the analysis of grain and seed was founded in Germany, under direction of Prof. Fr. Nobbe; a few year later, in 1876, public analysis of seeds was first introduced into Sweden, at Nydala in the Län of Holland. Swedish public analysis of seeds has thus been able to celebrate the thirty-first anniversary of a work which in more than

one respect has proved so useful to agriculture. At present there are in this country 19 offices supported by public subsidies. These offices were at first supported only by subsidies from the Agricultural Societies, but as early as 1887 the Riksdag placed 10,000 kronor (£583 6s. 8d.) at the disposal of the Government to be employed in support of such offices to which the County Councils and the Agricultural Societies were prepared to contribute an amount equal at least to that of the State subsidy, and which would submit at the same time to the regulations laid down by the Government. These instructions for the *seed controlling offices* issued by the Royal Board of Agriculture are similar to the regulations for the analysis of seeds adopted about the same date in Denmark and Norway. In 1901, our latest figures, the total number of analyses made at these establishments amounted to 11,273, while 3,743,357 kilograms of seeds were distributed.

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Plant Breeding in Sweden.

The Swedish Seed Breeding Association aims at an essential improvement of agriculture in Sweden by means of the *systematic raising of new and better sorts of plants*. The untiring labours of this Society since 1886 are now annually producing results which indisputably show that the right and practical course is being pursued. Its principal establishment, at Svalöf, in Skane, is already widely known both in and out of Europe, and is annually visited by numerous foreign students. The new varieties of seeds are, moreover, widely cultivated throughout Sweden, and are also beginning to attract the special attention of other countries. This distinct success, quite unexpected in a country situated so far north and so little favoured by nature, is to be explained by the fact that this establishment, fully equipped with the latest resources of science, has been founded *exclusively* for the purpose of improving the common agricultural crops. In this respect the institution at Svalöf is, we believe, still alone of its kind in the world. Hitherto the work prosecuted has been mainly as regards wheat, barley, rye, and oats, peas and vetches. A large assortment of entirely new varieties has been raised, only a few of which, however, and those only after most careful trials, have been brought into the open market.

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In connection with the above Experimental Association there is also a business undertaking under its control, namely, the *General Swedish Sowing-seed Company, Limited* (Allmanna Svenska Utsadesaktiebolaget), which receives, purifies by cultivation, and introduces into the public market the various new sorts produced by the Seed Breeders Association. Both establishments are, for the rest, entirely separate, each with its own financial management and staff of employees, estates, buildings, etc. There is at Svalöf an area of over 600 hectares (1,500 acres) of excellent soil at their joint disposal for agricultural operations and experimental cultures.

The Inter-Colonial Irrigation Commission.

During the past few months the members of the Inter-Colonial Irrigation Commission have been actively engaged on their important work. The Secretary, Mr. C. Dimond Braine, has held successful meetings at Vrede, Leeuwkop, Harrismith, Bethlehem, Fouriesburg, Ficksburg, Ladybrand, Bloemfontein (two meetings, one of which was held on the Show Ground at the time of the Agricultural Show), Brandfort, and Winburg. The Commissioners, under the Chairmanship of the Hon. Mr. Justice Wessels, visited Barberton, took evidence from nine witnesses there on the 26th April, and then inspected the White River Canal. On the 3rd May the Commission sat in Potchefstroom and examined six witnesses, after which they were shown the site of the proposed storage dam on the Mooi River. They also visited Haaskraal, which would be under the proposed canal, the Experimental Farm, and inspected the Carlis furrow running from the Mooi River to Loopspruit. On the 13th and 14th May the Commissioners sat in Pretoria and heard the evidence of various farmers.

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With the object of enquiring into the working of Water Boards, the Commission visited the irrigation works on the Breede River, Cape Colony, where they were met by the Director and other members of the Cape Irrigation Department. They held a conference with the members of the Robertson Irrigation Board, and afterwards visited the interesting work being carried out by the Nuy River Irrigation Board in the Worcester district. We understand that they gained much valuable information regarding the practical working of these Boards.

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A Farmer's Bulletin.

A timely and practical bulletin on "Small Pumping Plants for Farm Use," by Mr. M. R. Collins, Assoc. M.Inst., C.E., in which is incorporated a valuable paper on "Pumping Plant for Farmers," by Mr. G. O. Strachan, Inspector of Machinery, has been issued by the Department of Irrigation and Water Supply. The object of this bulletin is to give information regarding the pumping plants that are procurable in the Transvaal, in order to assist farmers and others desirous of erecting them for irrigation purposes or general water supply. It does not pretend to be an exhaustive treatise on the subject, but will be found of special use to those of our farmers who contemplate erecting pumping machinery. This bulletin (No. 3 of the Irrigation Department) can be had free on application to the Government Printer or to the Director of the Department of Irrigation and Water Supply.

Imperial Institute Report on Transvaal Cotton.

An interesting and instructive report upon the samples of cotton which were sent to the Imperial Institute by the Director of Agriculture through the courtesy of Professor Wyndham R. Dunstan, F.R.S.:—The most striking defect observable in ratooned cottons was the presence of stained, immature, and withered fibres. The same defect occurred, but to a more marked degree, in the first set of samples forwarded. The earlier specimens were unginned, and it was noticed that the bolls did not appear to have opened completely, as the cotton was in the form of solid masses, each having the exact shape of the capsule divisions. The stained immature fibres occurred generally at the base of each mass of unopened cotton, but, on ginning, they became distributed throughout the sample, thereby depreciating its value.

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Cotton of good quality is usually sorted before it is ginned, in order to prevent the inclusion of portions of inferior fibre. If it is desirable to cultivate ratooned cotton in the Transvaal rather than to sow fresh seed each year, it is of special importance that this sorting operation should be carefully and thoroughly carried out. In this way the stained and immature fibres, the presence of which constitutes a defect in the samples, could be excluded and the value of the ginned product greatly enhanced. The results obtained in the examination of the foregoing specimens, and, more particularly, of previous samples of similar varieties of cotton from the Transvaal tend to show that the product obtained from the fresh plants is superior to the ratooned cotton, and the former method of cultivation would, therefore, seem preferable.

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Other samples consisted of cottons grown from plants twice irrigated. They were not equal in quality to the previous samples of similar varieties as in most cases they contained stained fibres, which caused the cotton to be of unsatisfactory colour and uneven strength. It is probable that the stains had been caused by an insect pest, although it was impossible to determine this with certainty owing to the absence of seeds and to the distribution of the stains in ginning.

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From the results of the examination of selected American varieties it is evident that the cottons which show the greatest promise of success in the Transvaal are those grown from varieties of selected or improved American seeds. These cottons are more valuable than ordinary American Upland, and are likely to repay cultivation. None of the Sea Island cottons grown in the Transvaal have been equal to typical samples of the same variety grown in America or in the West Indies. It is important to note that this variety is seldom profitable when grown more than 50 miles from the coast.

The Egyptian cottons in this series are not very promising. Samples of Egyptian cotton from the Transvaal previously examined at the Imperial Institute were, however, o' better quality than the present specimens. Owing to the comparatively low commercial value of the Indian varieties, and also to the evident suitability of the climate and soil of the Transvaal for the production of the more valuable varieties, it would not appear advisable to cultivate Indian cotton. It will, of course, be understood that it is not possible to determine the suitability of a particular variety of cotton for cultivation in the Transvaal until several crops have been grown in successive seasons. The remarks now made are, therefore, subject to this qualification.

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South African Stud Book.

It is with pleasure that we call attention to the "South African Stud Book," which is an excellent record of all classes of stock, the object of the Association being to encourage the breeding of thoroughbred stock and to maintain the purity of breeds, thus enhancing their value to the individual owner and to the country generally. Application for membership in the Association and entries of stock in the Stud Book should be addressed :—

For Cape Colony, to J. Pike, P.O. Box 703, Capetown.
For Transvaal, to F. T. Nicholson, P.O. Box 134, Pretoria.
For Orange River Colony, to E. J. MacMillan, Government Buildings, Bloemfontein.

The Secretary of the South African Stud Book Association is Mr. J. Pike. The Stud Book is obtainable from Mr. T. Maskew Miller, Adderley Street, Capetown, at the price of 10s. 6d.

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The Michigan Agricultural College.

Our readers will be interested to learn that the Director of Agriculture has had the honour of being asked to take part in the recent celebration of the 50th Anniversary of the Michigan Agricultural College. This College, although one of the so-called land-grant colleges, was founded some years before the passage of the first National Act endowing an Agricultural College in each State through a grant of land from the public domain. The College is, in fact, by origin, not a national, but a State enterprise, and owes its foundation to the public spirit of certain charter members of the State Agricultural Society. These men, in 1849, the very year of the society's organisation, memorialised the State Legislature in favour of an "Agricultural College and Model Farm," and this memorial bore fruit the following year in Article No. 13 requiring the Government, as soon as practicable, to provide for an Agricultural School.

It was a herculean task to transform the wild forest into an orderly home for a great Agricultural School, and the conditions seemed by no means promising. Lansing, itself, where the College is situated, was, at that time, but a little clearing in the woods, accessible only by stage-coach and surrounded by dangerous swamps. The College farm was three miles and a half from this pioneer settlement. Of the six hundred and seventy-six acres taken up, only three were cleared, and, for much of the year, the road from Lansing to the building site was a bottomless swamp. It is small wonder, then, that nearly two years elapsed before the first buildings were completed and the school work started. Nevertheless, the date of the dedicatory ceremonies and of the formal opening of the College, May 13th, 1857, gives it an indisputable title to the distinction of being the first Agricultural College founded on the American continent.

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The fortunes of this new adventure in educational work were varied and fluctuating. The College was constantly before the Legislature; experiment after experiment was tried, and "reorganisation" became an almost chronic condition. Nevertheless, the Legislature has steadily befriended it, supporting it entirely during the formative period and during the eight or ten years which elapsed before the National Land Grant of 1862, or the *Magna Charta* of American Agriculture, began to be productive. To-day, the College is, in many respects, superbly equipped for the work of instruction and experiment.

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Under the present organisation, the College offers four main courses: the *Agricultural Course*, *Mechanical Engineering*, the *Women's Course*, and the *Course in Forestry*; each course requires either four to five years for completion, depending upon the amount of previous preparation on the part of the student. Those students who are graduates of accredited high schools, or have equivalent credits, can usually complete their college course in four years. All courses covering four years, lead to the degree of Bachelor of Science. Provision is also made for post-graduate studies leading to the degrees of Master of Science, Mechanical Engineer, and Master of Agriculture. There are fully-equipped laboratories and shops for the courses in civil engineering and mechanic arts. The library contains over 20,000 volumes.

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In addition to the regular Academic courses, a *Farm Home Reading Circle* is conducted by the College, comprising systematic reading and study along agricultural lines. Many people, both old and young, desire to get some training and knowledge in matters connected with farming or horticulture. The reading course is designed to offer to such persons an opportunity to read books adapted to their wants. There are courses in soils and crops, live

stock husbandry, garden and orchard work, home making, political science, etc. In all these courses the Michigan Agricultural College aims to apply practical science to the affairs of every-day life. Consequently, the lecture and laboratory are prominent features in this system of instruction.

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Special short courses for farmers, horticulturists and others unable to take the full agricultural course, but desiring to receive such help in their work as a shorter time can give, have been arranged as follows: courses of six weeks' duration in Creamery Management, in Dairy Husbandry, in Fruit Culture, and in General Farming and Live Stock; a twenty weeks' course in Sugar-Beet Production. Every undergraduate student, upon entering the College, is required to pay a matriculation fee of $5 (£1). This is paid but once, and entitles the student to the privilege of permanent membership in the College. Tuition is absolutely *free to all*, except those students from other States, who are charged a fee of $5 (£1) a term. The graduation fee is also $5 (£1).

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The College land, comprising 676 acres, is divided into a farm of 230 acres. The farm is equipped with cattle, sheep and swine of the principal breeds. There is also an arboretum of 150 species of trees, a botanic garden containing native and foreign hardy herbaceous plants, a grass garden of 200 species of grasses and clovers, and a weed garden of 100 or more species of the most troublesome weeds. The students in agriculture are required to work two-and-one-half hours each day on the farm or in the garden. The students, for the most part, live in dormitories or board in clubs. The average annual expenses of students for board, room rent, heat, light, books, laboratory, and other fees are estimated at about $125 (£25). These expenses are oftentimes reduced by receipts from labour performed on the farm or elsewhere about the College. The College is under the management of the State Board of Agriculture of which the Governor and the President of the College are members *ex officio*. There are somewhat over 30 professors and assistants in the faculty.

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The Experiment Station of the College receives an annual appropriation of $20,000 (£5,000) from the Federal Government, and $5,000 (£1,000) from the recent Adams Bill for purely research work. The experiments emphasise the various topics of pressing importance. They relate to animal and plant diseases, to insect pests and the best methods of fighting them, to bacterial problems, to the chemical composition of fertilisers and foods, as well as to plot experiments and the feeding and care of animals. The bulletin list now exceeds *50,000 names*, and through it the College reaches helpfully most of the intelligent farmers of the State.

This College has been the chief factor in the making of a great agricultural State; moreover, it has sent out many earnest missionaries to preach the gospel of rural husbandry, and we fancy the authorities must recall with just pride that the head of the foremost agricultural institution in America—the most inspiring personality in modern Agriculture—Mr. L. H. Bailey, of Cornell, was for some time Professor of Horticulture in the Michigan Agricultural College. And there are grey-haired pioneers still living who can speak of the days when they swung the axe in that primeval forest on the very spot where, to-day, there stands a handsome college with a muster roll of a thousand students; they, too, have lived to see the rise and growth of 63 similar Agricultural Colleges, claiming a total attendance of over 60,000 students. Small wonder it is that America is, to-day, the foremost agricultural country in the world!

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Spanish Jackasses.

A most attractive and pretty illustrated catalogue has been kindly sent us by Mr. H. Sessions, of Wootton Manor, Henley-on-Thames, the well-known importer of Spanish Jackasses. We abstract the following interesting passages:—

In Spain and the Mediterranean there are numerous breeds of asses, the most valuable being the Catalonian and the Andalusian, but, for mule-breeding, the former are preferred. The Catalonians are black with mealy muzzles and underlines. They are very tough and wiry animals, and quite the best sires for mules. Bred in the mountains and somewhat inter-bred, when crossed out they get bigger stock than the larger jacks raised under favourable conditions.

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The Catalonian jack is the foundation stock of the Kentucky jackass, importations having been made in the early half of the last century to the United States of America. In many of the American donkey-breeding farms the stock has got a cross of Poitou as well as the Catalans, and some very fine jacks are bred. The produce of these jacks are the 16-17 hand high mules which we see in Missouri and Kansas and some of the Eastern States of North America, and for weight and substance I do not know any part of the world which equals them. It is noted, however, by American breeders that a Catalonian jack of 14 h. 2 in. high will produce as equally big a mule as an American-bred jack of 15 hands, and American breeders, in order to keep up the vigour, character, and quality of their studs, keep importing Catalonian and Poitou jacks.

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In South Africa the native breed of donkey is small, and, in South America, they are somewhat similar, but, on both continents, they are being graded up by the use of imported Spanish sires. In Ireland, where there are about a quarter of a million donkeys, an effort is being made to increase the usefulness of the native donkey

by the use of jackasses of larger size and better breeding, and there is no reason why Ireland should not produce jackasses of great bone and quality, fit for mule-breeding in any part of the world, and a market can be opened up with India and our own Colonies where the demand for good jacks will probably increase for many years to come.

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Rates of Shipment of Grain.

The General Manager of the Central South African Railways writes to the Director of Agriculture as follows:—

"I have pleasure in intimating that an agreement has now been come to between the various Administrations to charge one-quarter of the published wool rate for grain shipped beyond South Africa. The conditions are that the grain must be forwarded in ten ton lots or paying therefor, full rates being paid in the first instance, the rebate—which will be effective from the 10th instant—being granted, subsequently, on customs proof of shipment. The new rate is subject, on the Natal side, to a minimum charge of 9s. 6d. and 13s. 4d. per ton *via* Van Reenen and Charlestown respectively."

The following are the rates which at present obtain for

South African Mealies.

From Pretoria	to	Capetown	..	£3	6	10	per ton.
,,	,,	Durban	..	1	18	4	,,
,,	,,	Delagoa Bay	..	1	3	0	,,

South African Wool.

From Pretoria	to	Capetown	..	£5	0	0	per ton.
,,	,,	Durban	..	2	15	0	,,
,,	,,	Delagoa Bay	..	2	12	6	,,

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The South African Farmer's Guide and Handbook.

We have received, through the courtesy of Messrs. P. Davis & Sons, 244, Longmarket Street, Maritzburg, a copy of the first issue of the South African Farmer's Guide and Handbook, which can be obtained at 1s. 10d., post free. The volume under review contains a large number of useful notes and brief papers taken from the "Natal Witness," on such subjects as stock-farming, fruit growing, horse breeding, poultry raising, etc., which will doubtless prove of value to the farming community. We should like, however, to suggest that a slightly higher price be charged in order to clothe the book in a strong and serviceable cover, to secure better printing, and a more systematic arrangement of the several items.

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Poultry Supplies Catalogue.

We are requested to draw the attention of our readers to the latest "Poultry Supplies Catalogue," published by Messrs. George Findlay & Co., Capetown, which is copiously illustrated and can be had free on application to this firm.

South African Forest School, Capetown.

We are asked to insert the following notice for the benefit of our readers:—

"In the 'Government Gazette' for the 17th May, 1907, a notice is published giving full particulars regarding the Organisation and Equipment of the South African Forest School, Capetown. Information in regard to the conditions of entrance to the school and the examinations held by it will also be found in the notice referred to."

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Specimens of Diseased Plants.

Mr. I. B. Pole-Evans, the Acting Botanist, asks us to earnestly impress upon our correspondents the absolute necessity of submitting samples of diseased specimens of plants about which any information is desired. Letters unaccompanied by the specimens referred to are of no value, and an accurate determination of the true nature and cause of the disease is manifestly impossible.

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Report on Rubber Latex from the Transvaal.

The Conservator of Forests kindly sends us the following report from the Director of the Imperial Institute on some samples of latex from a supposed rubber-yielding tree sent to the Department of Agriculture by Captain Madge:—

"This sample of latex, stated to be derived from an Euphorbiaceous tree called 'Mutlalamela' by the natives in the Transvaal, was forwarded for examination to the Imperial Institute by the Director of Agriculture. The latex, which had partly coagulated during transit, had a slight acid reaction. The fluid portion could be coagulated by the addition of glacial acetic acid but not by dilute acetic or mineral acids; alcohol or acetone caused immediate coagulation. A quantity of the latex was coagulated by the addition of acetone, and, after drying for three days in the air, the resulting product was analysed. The material is of a very resinous character, and the constituent returned as *caoutchouc* did not exhibit the characters of true rubber but became friable on drying.

This material is very similar in composition and properties to the previous specimens of a product derived from another Euphorbia in the Transvaal. It could probably be sold as 'Almeidina,' the current value of which, in England, is 56s. per cwt."

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An Injurious Weed.

Mr. Mundy, the Assistant for Seed and Plant Experiments, writes a warning paragraph regarding an injurious weed, as follows:—

Since sending in my article on the "Spread of Injurious Weeds," another plant has been reported as showing a dangerous tendency to spread. This plant, known botanically as *Tagetes minuta*, L., belongs to the Marigold family, and, like these, is remarkable for its strong, pungent smell.

In appearance it is a tall-growing, feathery plant, usually from 3-4 ft. high, and bearing a mass of small yellow flowers in terminal panicles. A native of South America, it probably owes its introduction into this country to the mealies and fodder which were brought in during the late war.

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This weed has made its appearance in the neighbourhood of Volksrust and Charlestown, and shews every sign of becoming a cause of serious trouble in the lands. Shedding seed in enormous quantities, it is likely to come up thickly in the spring and cause much damage by smothering out the young corn crops. We are further informed that it does not burn readily, and, therefore, the only method of eradicating it appears to be by ploughing it in or by continual hoeing while the plants are young.

Owing to the fact that it has established itself at Charlestown, just across the border, the difficulty of dealing with this plant is increased, but steps are being taken with a view to arranging a joint scheme whereby the spread of *Tagetes minuta* may be checked. We shall be glad to hear if this plant is known to appear anywhere else in the Transvaal.

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Transvaal Tobacco for New Zealand.

Enquiries have been received from New Zealand for a good light grade of cigarette tobacco packed in a suitable form for the retail trade. There already exists a considerable demand for this from the various cigarette factories in South Africa, so that, with an evidently widening market, the cultivation of such a class of tobacco should be well worth the attention of planters.

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Agricultural Shows.

This year has been one of unusual activity amongst the farmers, with the result that several very successful shows have been held at the various centres; in fact, in point of numbers and all-round quality, none better have been known in the history of this Colony. Moreover, it is already apparent that the day is not far distant when the Transvaal will successfully rival the older States in the number and excellence of her exhibits. In a word, the promoters of these exhibitions, both the townsfolk and the farmers themselves, are to be heartily congratulated on the success of their energy and enterprise. For, of all educational factors in Agriculture, there is none more essential than the Annual Show.

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Volksrust.

The Wakkerstroom Agricultural Society held its annual show at Volksrust on the 27th and 28th of February, and was opened by Mr. F. B. Smith, the Director of Agriculture. The weather was superb, and everything combined to make this show a great success, and people from all parts of the Transvaal turned out to do

honour to the border town. In the cattle section there was a very fair exhibit. The entries were good, but the quality was not up to the general expectation. In a few classes, however, some of the animals were of special merit. In the class of Africander cows the prize animal showed the merits of the breed in a high degree, and these remarks apply equally to a two-year-old heifer which was awarded the palm in her particular class. The Friesland section merited the highest praise. Here, at least, were some animals which were equal to any that have yet been exhibited in this Colony. Of special note was the three-year-old bull and cow in milk belonging to Mr. J. J. van Niekerk. Another animal deserving special mention was a South Devon bull belonging to Mr. T. L. Moller and bred by Mr. W. R. Southey, Cape Colony. In the Shorthorn classes a pen of three-grade animals bred by Mr. Nourse, of Volksrust, received a good deal of attention. These are types of animals well suited to the prevailing conditions of the High Veld where, at present, animals are largely left to rustle for themselves.

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A singular point brought out at this show is the amount of inter-crossing which has taken place resulting in a lot of animals of no special or fixed type. Our farmers would do well to consider the different breeds, and, after having definitely made up their minds as to which breed or grade is best adapted to their particular needs, to press forward towards that ideal. Nevertheless, these exhibits indicate much progress during the past two years and are hopeful signs pointing to a bright future for the cattle industry on the High Veld. There is still another matter to which we would like to draw attention. The country all around Volksrust is eminently suited to cattle raising. At present, men's thoughts are turned mostly to sheep, but so long as there are liable to be losses amongst sheep, it might be advisable for farmers to safe-guard themselves against the days of drought and sickness by placing a certain amount of their surplus capital in cattle in this part of the Colony which is so peculiarly free from disease amongst horned stock.

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The merino sheep were a very creditable lot, and, in some cases, the quality of the exhibits was exceptionally good, especially in the robust type. Unfortunately, some farmers exhibited robust sheep in the fine-wool sheep section. Consequently, although the robust sheep were better than the fine-woolled sheep, the judges had to disqualify them. On account of this we would suggest that there should be three classes instead of two, as formerly: (1) fine, (2) medium, and (3) strong, as, in many instances, farmers cannot well discriminate between the different qualities and strengths of wool. Moreover, the judges themselves differ widely between the words *fine*, *medium* and *strong*. Further, we would recommend that competent stewards should go around, previous to the judging, and arrange the sheep

according to their proper classes. On the whole, the sheep were well grown considering the bad season, the 2-tooth being exceptionally large for their age and well covered.

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Some of the horses were of a high order, but there were many others of which it may be said that it must have been patent to their owners that they will have to alter their breeding standards if they intend to become successful exhibitors. Poultry made a poor show, the exhibits being practically confined to turkeys, ducks and geese. It is regrettable that more interest is not taken in the Poultry Section in this district—a remark unfortunately true of the whole of the Eastern Transvaal. Another point to be emphasised is the need of proper exhibition pens which enable the birds to show themselves to better advantage. Again, too little attention is devoted to placing the birds under proper cover to protect them from the hot sun. The produce section was poor, and vegetables made a disappointing exhibit. Some of the carrots shown were fanged—a malformation commonly due to roots growing on land which has been too heavily manured. Mr. William Gillespie, of Rietpoort, Zandspruit, exhibited some bales of teff-hay. He informed us that he had 30 acres of teff, and he thinks very highly of its feeding value. To the enthusiastic and tireless President, the Hon. A. G. Robertson, M.L.C., his hardworking Committee, and the painstaking and obliging Secretary, Mr. G. Maasdorp, our heartiest congratulations are due for the general arrangement and conduct of this show, which cannot fail to stimulate a spirit of generous rivalry amongst the various Agricultural Societies throughout our Colony.

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Ermelo.

The second annual show of the Ermelo Agricultural Society was held at Ermelo on the 14th of March. The weather was perfect and the attendance large. The show ground, which is picturesquely placed, is one of the prettiest in the Colony; and, the previous night, a number of visitors came from Johannesburg and Pretoria by the first through train to this part of the world. Early in the morning the whole town was astir and judging was in full swing by 9 o'clock, but, shortly after 2 p.m., the show was practically over. The same thing happened last year and led to some criticism, and it does seem a pity that, when people come from afar, that so little chance should be given of thoroughly studying each exhibit. Of course the reason for closing in the early afternoon is to allow the remoter farmers to reach their homes that same night, but an agricultural show takes place only once a year, and we do think that a full day devoted to the exhibits would give greater satisfaction all round.

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Naturally, the sheep section was the centre of attraction. Unfortunately, both the animals and the wool were weak, and were a source of disappointment. At the same time, we must not omit to

mention that the change of date from the 21st of February to the 14th of March had something to do with the fewness of the entries. Further, we understand that Messrs. Buhrmann, the well-known breeders, did not care to exhibit on account of the prevalence of blue tongue, which, unhappily, caused much loss at this season of the year. Two animals were specially worthy of mention: one, which took the Championship, a fine, well-framed merino ram belonging to General Erasmus, and bred by Mr. J. H. King, of Cape Colony; and a prize ewe which was bred by Mr. Labuschagne. We were struck with the fact that most of the sheep were rather out of condition. Ermelo is the heart of the sheep country, and we look forward hopefully to a better exhibit next year. Moreover, it was regrettable to learn that there were no entries for the five-guinea silver cup offered for the best exhibit of wool. The cattle section was highly creditable, particularly the Africanders. Mr. J. R. Buhrman, of Emigratie, won the first prize in his class, while Mr. Turner's handsome Friesland bull was also an easy winner. Trek oxen were specially strong—indeed we do not remember having seen a finer display for a long time. Horses, we must confess, were not up to the mark considering that the High Veld represents possibly the finest breeding ground in the world. However, we confidently look forward to a better exhibit next season, because many farmers have had the use of the Government stallions, and we expect to see amongst the first crop of colts some worthy representatives of the best blood of England combined with the staying power of the Boer pony. To a capable Committee, together with the organising ability of the Secretary, Mr. Alexis Smuts, the success of this show was largely due.

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Standerton.

The second annual show of the Standerton Agricultural Society was opened by His Excellency Lord Selborne on Wednesday, the 27th of March, and passed off most successfully. At the same time, it was generally agreed that the attendance would have been larger and the entries more numerous had the Vrede Show not clashed with that of Standerton. Last year, the Standerton people depended largely upon the Orange River Colony farmers for support in the various classes, and this clashing of interest was most regrettable, materially affecting the entries at both places. Another cause which interfered with the number of the cattle exhibits was the "three-day" sickness, which caused many competitors to cancel their entries. In point of entries the exhibits were as good, if not better, than those of last year. In the wool classes it was gratifying to find a very large increase in the entries, but sheep showed a decided falling off in numbers. On the other hand, there was a material gain in horses, at least one-third more than last year. The cattle classes, notwithstanding the cancellation of so many entries, were much more numerous than last year. The show suffered, however, from the fact that it was scattered over too large an area, and an effort should be

made next year to concentrate the various classes into a more compact space, whilst the arrangement of the several exhibits indicated a lack of systematic classification.

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A Word to Sheep Farmers.

Lord Selborne, in reply to the address which had been presented to him, spoke as follows:—

Gentlemen, I stand here in, perhaps, one of the greatest sheep districts in the Transvaal, and in South Africa. Now, what is the greatest sheep district of the whole world, and where is the science of rearing sheep and breeding sheep and bringing wool to the market best understood? Where are the best merino sheep in the world? In Australia. Where did the best merino sheep come from which went to Australia? They came from South Africa. (Hear, hear.) Now, why is it that the Australian farmer has got ahead of you? The country is no better, the men are no better, but they have taken more trouble. They have worked much harder, both with their hands and their heads. They have got no Kaffir labour there. It is all done by themselves, and this wonderful breed of sheep that they produce from what they got from South Africa was brought about with their own hands and heads. There is no reason why you should not catch up to them and pass them again—(applause)—but it depends entirely and only upon yourselves. If you take care of your sheep, always go on improving and improving the breed and take the same care as the Australians do, and if you take as much pains as they do with bringing wool to the market in the way people who buy will want it, in a year or two South Africa may be the largest sheep-farming country in the world, and Standerton the best district in South Africa. (Hear, hear, and applause.) But, as I said before, it does not depend on the Government, it depends on yourselves. All that a Government can do is to give you help, and I am quite sure nothing is nearer to the heart of the present Ministry, as it is to mine, than to give all the help that a Government can give. (Applause.) Gentlemen, we want to see the show. Now, I will only thank you for your kind welcome here to-day. I say once more what pleasure it gives me to be here. I now declare the show open.

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The classes for horses were an improvement on those shown at Volksrust last month. The advance was most noticeable in the class for mares with foals at foot, which may be attributed to the fact that the Agricultural Department have placed several good sires in the district; but the pedigree classes were poor with the exception of the Government exhibits. There was a large exhibit of sheep, but the quality of the exhibits was not what one would expect in a district specially suited to this industry. In the cattle classes, Frieslands formed a strong class, but the animals shown were not up to the standard of other shows. An exception to this remark were the

excellent animals exhibited by Mr. J. J. van Niekerk. The Shorthorns were very disappointing, and the animal which was awarded first prize was a rather poor specimen of this breed. The Africander classes were strong in point of numbers, and the quality of the exhibits was good. The exhibits in the produce classes were very small. The farmers in the Standerton district may well be congratulated on possessing such an energetic worker in the cause of agriculture as Mr. A. H. Malan, who spared neither time nor energy to bring this show to a successful issue.

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Klerksdorp.

The Klerksdorp Agricultural Society experienced the most wretched weather for its tenth annual exhibition, on Wednesday, April 17th. Rain fell almost without intermission from early morning—indeed it set in late the night before, and continued all day with a persistency that would have been welcomed at a more seasonable time.

But is was not only rain, and mud ankle-deep in the show ground, that the Klerksdorp Society had to fight against, for, this year, horse-sickness has been rife in the district, and the losses of farmers in this respect have been heavy. Blue tongue had also appeared among the sheep and spread death among the flocks. One exhibitor could muster only two pedigree rams out of the eight which he had purchased at considerable cost a little while back. Added to these misfortunes, unfortunately too common, there were the ravages of the locusts; so the farmers in this district suffered heavily indeed.

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The Hon. the Acting Premier and Minister for Agriculture, General J. C. Smuts, opened the show, and, in replying to the hearty welcome of the Society and Municipality, spoke as follows:—

He had seen some things that day which were very encouraging He had seen some of the work done at the Experimental Farm at Potchefstroom, which was shown that day. He had seen a cross of sheep there that day that might revolutionise the sheep industry of the lower veld—a cross between Shropshires and their local sheep of rather a low type, which, if they were domesticated in the lower veld, might revolutionise the use of that country for pastoral purposes. He had seen other things, too, that showed him they were moving in the right direction. After all, it was the right direction. It was useless for them in this country to think they could all become parsons or lawyers—(laughter)—or clerks.

Since he had become a member of the Government he had been inundated by hundreds—he might almost say thousands—of applications by people who wished to enter the Government service. There was no future in that direction. So long as the people in this country looked to the Government service and the professions, so long were they looking into a blind alley which had no permanent prospect.

There was only one long vista before this country, and that was the agricultural vista. If they moved in that direction he was sure that they would have a great and noble future in the Transvaal. (Applause.) What was the position of the country to-day?

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The Stream of Gold.

They had a stream of gold—26 millions per annum, or more—flowing like the Vaal in the O.R.C., out of this country to foreign countries. The great problem before this country was *to make a furrow* and divert that stream, and, as they used the waters of the Schoonspruit and the Mooi River and other streams to irrigate the land, so it ought to be more and more the policy of the Government of this country *to divert part of that stream of gold which was flowing out abroad, and see that some of it went to benefit their agricultural population.* That could only be done by agricultural development. It could only be done very largely by the two words that had been made use of in the address of the Municipality, co-operation and irrigation. He knew, as a matter of fact, that the mining industry to-day was anxious to buy on a very large scale from the farmers in this country. If there was co-operation amongst the farmers, so that they could meet the demands which were being made daily by the mining industry, he was certain the farming and agricultural community would be benefited to a very large extent, far larger than in the past, by the efforts of the mining industry. What was the case at present. One farmer had some bags of mealies, another had some other sort of agricultural produce, but the man who wanted thousands and thousands of bags could not go to each individual farmer and buy from him. It was easier to go to the local merchant, and, in some cases, to the foreign merchants, and the result was that, in this country, they were supplied from abroad with produce that should be grown in the country. They would find from the statistics that they were importing millions' worth of stuff every year that ought to be produced in the Transvaal. (Applause.) It seemed a small thing, but in reality it required a very special effort to have small agricultural societies such as were covering the face of the earth in other countries; but a move must be made—a beginning must be made.

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The First Effort.

He sincerely hoped it would be one of the first efforts of the Government of this country to encourage co-operation and the establishment of co-operative societies by setting aside a sum of money for the purpose of stimulating the efforts of the societies, and so give them a start and a chance to become useful and flourishing institutions. If the farmers would learn to co-operate and bring their produce together to sell to the large buyers, then agriculture in this country would be revolutionised,

and then they would not see that state of affairs which they saw that day in the country—one day seeing a bag of potatoes costing in the market 30s., and, on another, something like 5s., or even less. As long as they did not co-operate and organise the agricultural forces in this country, so long must they be satisfied to be beaten all along the line. There was only one way to success; that was co-operation. People talked about federation and big things of the world, which were good in their place. They should start with small things here, and not work for big ideas whilst their agriculture and other industries were languishing and going to ruin. Let them build from the foundation, so that they should have union in this country, and that they should have a prosperous South Africa and a prosperous Transvaal. (Applause.)

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The Klerksdorp Society is to be congratulated on the excellent show of cattle put forward to judge, and, further, for the admirable arrangements for shedding, kraaling, and showing the exhibits. It would be to the advantage of the secretaries of other societies to pay a visit to the Klerksdorp show ground in order to study the method of laying out grounds and the general arrangement of buildings for stock. Touching the various breeds of cattle exhibited, the Frieslands predominated in numbers, and, with respect to quality, they must also be ranked first. In the class for imported bulls, there were two nice specimens, while in that for Colonial bred bulls, an animal of specially high quality was exhibited and was awarded the championship for the best bull in the show yard—a well-merited honour. The Friesland cows, both imported and Colonial bred, did not come up to the desired standard; on the other hand, in the class for Friesland heifers, not only were the entries numerous and competition keen, but the quality was particularly good. The exhibits in the Shorthorn classes, though not numerous, were of a fairly high order as regards quality—particularly a Lincoln red bull and a pen containing a couple of heifers, one of which was reserved for the championship. One word of criticism. It was disappointing to notice ticks on several of the animals exhibited, and we are sure this passing remark will impress upon our stock farmers the desirability of showing, in future, only tick-free animals.

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Respecting the sheep exhibited, we should like to emphasise the remarks we have already made with regard to proper classification to facilitate judging. Furthermore, exhibitors should be made to state the date upon which the exhibits were last shorn—this, for obvious reasons, is most necessary—and all animals should have at least four months' wool on. Considering the interest which is being taken in horse breeding in the Transvaal, we were rather disappointed in this section. At the same time, it must be remembered that the past season has been particularly hard, and horse-owners have suffered

severely owing to the ravages of horse sickness. In the stallion classes, the judge decided not to award a first prize in either class, owing to lack of merit. Moreover, the general scheme of classification was unsatisfactory, as thoroughbred and cart horses were put in the same class. In conclusion, we should like to remark that it was gratifying to observe the comparative absence of hereditary disease amongst the Colonial bred horses exhibited. At the same time, there remains much to be desired as regards their conformation, and bad frames, defective action, and want of size are still common defects. This can only be remedied with skilful mating, and by more attention being paid to the selection of both sires and dams.

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The building for housing the poultry exhibits reflected great credit upon the Klerksdorp Agricultural Association, which is the only society, so far, that has gone to the trouble of erecting a special poultry shed and proper exhibition pens. The shed is so designed as to allow of ample space and light—the two most essential points—and on a fine bright day, it would be as light inside as in the open day. This was the best poultry exhibit we have seen, as yet, in the Transvaal. It was gratifying to note that no diseased birds were on show, and the majority of the specimens were in excellent condition. Of other items of interest we may mention a Cape cart made from Colonial wood at the Industrial School at Potchefstroom, built of stinkwood, yellow-wood, and kareeboom. The success of this show, as in former years, was mainly due to the untiring efforts of the genial and popular secretary, Mr. H. Bramley.

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Waterberg.

The first annual show of the Waterberg Agricultural Society took place on the 30th of April. Although this show makes no claim to the importance of those of larger centres, the exhibition was most creditable, and indicated that the Waterberg District is specially adapted to the cultivation of certain classes of produce. Like kindred bodies which, one by one, have awakened, the Waterberg Agricultural Society has been in a dormant state during the past few years. However, the proposal to resuscitate it, when first mooted a few months ago, received the support of all sections of the community, and culminated in a most successful display. At the outset, the revived society, like most others, had financial difficulties to face; for the old buildings were destroyed during hostilities. An appeal to the Government, however, led to a compensation grant of £350, of which £280 has, so far, been paid. Part of this sum has been applied to the erection of a commodious new hall, with offices attached, which was completed in time for the show. The exhibition site, which is located across the drift, about a mile from the town, has a picturesque outlook. There were 20 classes of exhibits, making close on 300 entries, and for which the substantial sum of £200 in prize money was provided. The show was formally opened up by Mr. F. B. Smith, Director of Agriculture, shortly after noon.

There was not much competition in the various classes and sections. Cattle, especially the Africander breed, was the strongest class in the show, but, even here, there was but little competition, and, while the animals were a serviceable lot, it was obvious that there was room for considerable improvement; and that, if the successful exhibitors intend to compete in the larger shows, some fresh blood would be required. The show of sheep and goats was disappointing, only seven classes being entered for out of ten, and, in practically every case, only one competitor had entered. Even the sheep that were on view could hardly be said to be up to the average of the district. Horses, though few in number, showed a distinct improvement, and Mr. A. H. Hilliard had a well-deserved win with his South African bred stallion. The poultry section was a good one and rivalry there was keener. Owing to the season of the year, fruit and vegetables were scarce, but the samples of fruit shown were sufficient to indicate the possibilities of the district, especially in the way of the citrus varieties. The lemons sent in by Mr. C. S. Potgieter would have taken a prize anywhere. The arrangements were in the hands of a strong Committee, of which Mr. J. C. Krogh, R.M., was the President, and Mr. E. Tamsen, Chairman. Mr. J. van Backstrom made an excellent Secretary, and carried out his duties to the satisfaction of everyone.

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Heidelberg.

Magnificent weather favoured the Heidelberg Agricultural Show, which was held on Wednesday, the 8th May, and opened by the member for the district, Mr. Andries Stockenstroom, M.L.A. When it is remembered that this is the first agricultural show ever held in Heidelberg, the members of the Committee deserve to be heartily congratulated. As a first attempt, the show was remarkably well managed, and supported by the farmers as well as the general public in a most encouraging manner. Some of the animals in the pens were of a specially high quality. The cattle formed a fine exhibit, and so did the horses. The various classes of poultry were well patronised. The special prize of five guineas for the best Africander bull, presented by Mr. F. J. Bezuidenhout, sen., was won by Mr. J. H. van der Merwe; while another special for the best Friesland cow in the ring went to the well-known exhibitor, Mr. J. J. van Niekerk.

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The exhibits of sheep were not numerous, and there was but little competition. Mr. D. E. Erasmus carried off the honours with his ram "Bismarck," bred by Mr. J. H. King, of Tarkastad District. This ram is a fine animal, combining in a remarkable degree size and symmetry, and a long dense fleece. He took the first prize for the best Merino ram bred in South Africa, and a first prize in his own class. Although the entries in the horse section were not numerous,

many of the animals were of good quality. Mr. F. J. McHattie carried off seven prizes, including a special prize for the best animal in any class bred in the district. The Hon. H. Wyndham took the first prize for the best thoroughbred mare, and Mr. B. F. Webb for the best Boer mare. The show of produce was exceptionally good.

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Witwatersrand. The first show organised by the Witwatersrand Agricultural Society since the year 1899, held on May 15th, 16th and 17th, proved the most successful in the history of Transvaal Agriculture, and is clearly destined to become one of the largest in the whole of South Africa. This splendid start is undoubtedly due to the energy and enterprise of the Committee, to the whole-hearted support of the President of the Society, Mr. Lionel Phillips, the hard-working and courteous Secretary, Mr. W. H. Poultney, as well as to Messrs. Charles Wood and John Roy, M.L.C., who devoted a large part of their time to the interests of the Society. The new show yard, which is situated to the north of Braamfontein Cemetery, is an immense improvement on the old one, and covers 30 acres of ground. A considerable sum of money has been spent in laying out the ground and erecting up-to-date buildings. A large ring, which is said to be the finest in South Africa, and which is only 25 yards shorter than the ring of the Royal Agricultural Society in England, provides ample room for riding and driving competitions. The fact that the yard is situated so conveniently near town materially added to the popularity of the show. To give an adequate idea of the comparative size of the show with those of Cape Colony, it is only necessary to mention that the number of entries at the recent Port Elizabeth show were 2,800, while, in Johannesburg, there were 2,300.

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At noon the show was formally declared open by His Excellency the Governor, and at luncheon, in the presence of a distinguished and representative gathering, Lord Selborne proposed the toast of Agriculture in the following terms:—

"The toast which has been entrusted to me is the toast of 'Agriculture,' agriculture in the Transvaal, agriculture in South Africa. I am generally described by the Press on this subject of agriculture as an optimist—and I am not the least ashamed of the description. I have said before, and I say again, there is nothing wrong with the soil or the climate of the Transvaal. There is nothing wrong with the physical or intellectual capacity of the men who farm, but there is something wrong. There are the plagues of Nature, but they can all be fought and beaten by the combination of your admirable Agricultural Department and the farmers, and there is something wrong, not with all, but some of the farmers. They have the physical and intellectual capacity, but they do not use it as they should, for one or two reasons. Sometimes it is want of knowledge;

other times it is laziness. Now, we are very accustomed to read in South African journals of this or that mining proposition which cannot attract sufficient capital, although, if the capital were forthcoming, there is an adequate reward for those who put their capital and their labour into it. But I submit to you, gentlemen, that, in the sphere of agriculture, there are sovereigns positively lying upon the veld, which men do not stoop to pick up. Now, I will give you two instances of that. I heard the other day—and, indeed, I have seen the same thing with my own eyes—of a mealie crop that was a failure. It produced about two bags per acre, or was calculated to produce about two bags per morgen, and that was not the fault of the locusts, and there had been plenty of rain, but the mealies had not been harrowed. And why had not the mealies been hoed? Because there was not Kaffir labour forthcoming. I ask what of the farmer—and he had two sons—what had he been doing while the weeds were growing? And I was informed that he had been looking on.

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"Now, there was a case of a man deliberately, from one of the two causes I have mentioned, refusing to stoop down to pick up the sovereigns that were lying on the veld, and, indeed, if he had profited by all we know about agriculture, he need have done very little personal hoeing, for, if the mealies had been properly drilled, he could have horse-hoed them. And, gentlemen, what is a great show like this for except to assist forward the movement of mutual help among farmers—to show farmers by each other's experiments what experiments produce good results, to assist each other by their advice and encourage them above all to co-operate. No really great or successful results have been achieved in modern times except by co-operation among farmers—co-operation assisted undoubtedly by the Agricultural Department of the State. But the State cannot rear farmers by the hand bottle. All it can do is, when they are ready to help themselves, to give them that help which the strength of the State can give. That has been, and is, the continual effort of your Agricultural Department.

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"Gentlemen, what is the cure, the permanent cure, for those two evils—want of knowledge and want of effort. It is education, and it is because the whole strength of the State should be exerted to bring out the real full physical and intellectual capacities of the population that the Government, supported by every section of public opinion, will do all it can to promote the education of this Colony—education, not only in its broad general line, but education industrial and agricultural. There are many subjects on which, in the natural course of things, public opinion, here as elsewhere, is much divided, but I know no happier augury for the future than that on this subject of education; there is no difference among parties in the Transvaal. And, gentlemen, this Witwatersrand Show is an effort to provide persons unconnected with the Government to assist this great

agricultural and educational movement. I think I am entitled on behalf of the Government to thank all those who have assisted in organising, in recuperating, in once more starting this great show. Happily, Mr. Phillips, this is not the only show in the Transvaal. Others are too numerous to mention, but, from its natural position, from circumstances familiar to all of us, the Witwatersrand is especially in a favourable position to inaugurate and to sustain a show of the first class. Our thanks are due, warmly due, to those who have done it, and I thank you, sir, for the opportunity you have given me to-day of proposing the great toast of Agriculture. I will couple with this toast the name of Mr. de Villiers, the Minister of Mines."

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After dealing with various pressing problems, the Hon. J. de Villiers, M.L.A., spoke as follows:—

"Many people think that the difficulties of the farmer are merely imaginary. Lord Selborne has pointed out some of the difficulties and defects of the farmers, but very often it is owing to the men having entirely lost heart. Year after year they have been trying to grow crops, and these have been a failure. It is for the Government to step in, because I feel that all these diseases and pests should be dealt with by concerted action all the way from Capetown to here. Unless this is done, these pests cannot be dealt with. The old Republican Government had already done a great deal for agriculture when they induced Dr. Theiler to come to this country, and the new Government has done the same when they had retained the eminent services of Dr. Theiler. I do not know enough of the Witwatersrand Agricultural Society to speak myself on its achievements, but the outside public of the Transvaal owe a great debt to the committee of the society and to the men who have so munificently contributed funds towards the establishment of these buildings and grounds here. There is just one thing that I wish to express before I sit down, and that is that the subject of agriculture is of such importance that I hope you gentlemen who are townsmen will make it your business *to consecrate at least one of your sons to agriculture.* (Hear, hear.) If you do that you will bring the country population and the town population together, and I feel that agriculture will have a great and honoured future before it then." (Applause.)

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Now, with reference to the exhibits. No fewer than 398 horses were entered, many coming from the Orange River Colony, the Cape and Natal, including 19 thoroughbred stallions, which competent critics maintained would do credit to the famous Dublin show. It is evident, so far as thoroughbred horses are concerned, that a marked improvement has been effected within recent years, and some of the best blood has been obtained from the Old Country. This show clearly demonstrated something of what has been achieved, and the judges' comment on the class for thoroughbred stallions as "*quite one of the*

best that has been shown in the country" was most gratifying. Among the horses the judges had no difficulty in making their selection as to the one entitled to first honours. Mr. Abe Bailey's horse, "Leisure Hour," the judges remarked, is a most perfect horse in shape and symmetry, and is a typical St. Simon of the best colour—a bay with black points—and no higher commendation can be paid than to say he very much resembles his relative, His Majesty's famous horse "Persimmon." Leisure Hour can hardly fail to leave his mark in the country. That old racecourse hero, Chesney, a chestnut in colour, was placed second. The remark to the judges' award was "a full muscular horse, lacking the quality of Leisure Hour." Mr. Wyndham's Narhillah is a nicely-modelled horse, just the stamp that is required for this country. Three others whom the judges specially commended were Herniston, Springtime and Altair. The last-named, a New Zealand bred horse, is brimful of quality, while the other two, the property of the Government, are handsome horses. Only one South African bred stallion was entered, "Bedouin," belonging to Mr. B. P. Johnstone. In the thoroughbred mare class those shown, imported or otherwise, were a high-class lot, and the first award went to an exceptionally fine mare, "Pearl Queen," bred by Mr. C. Southey.

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In view of restrictions regarding the introduction of cattle into the Transvaal from the neighbouring Colonies, the large number of entries in this section was considered most encouraging. No cattle at all were allowed to be brought in from Natal, and those brought from the Orange River Colony and the Cape could not be returned to their owners there. Had it not been for these precautions, which of course are essential to prevent the spread of disease, the entries would have been very much more numerous. The cattle classes were well filled, but, as a whole, were wanting in quality, although there were a few animals of outstanding merit. Considering the large number of Friesland cattle now in this Colony, the exhibit of this breed was not what it might have been. Then, again, some of the animals were not in the best condition. In the Friesland class, the first prize for the best imported cow went to Mr. E. B. Moore, while the award for the best cow bred in South Africa was won by Mr. J. J. van Niekerk's "Appel," and for the best red Africander bull over 2 years the prize went to Mr. A. C. Greyling. First prizes for the best Red Poll, Hereford, and Ayrshire bulls were won by the Department of Agriculture, which thus secured three out of the four championships. A red Africander cow of Mr. D. E. Erasmus took a first prize, and the award for the best dairy cow (any breed) went to Mr. Charles Beel's Friesland; whilst the prize for the best bull in yard was taken by Sir George Farrar's fine animal "Bracebridge Sandbrook."

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On the whole, the sheep exhibit was not up to the standard anticipated. The wool was poor, too open, and lacking in density.

Owing to the recent ravages of blue tongue, it was hardly a matter for surprise that the sheep classes were not better filled. Another factor which militated against a large entry was that most farmers had already shorn, and some sheepmen had just sent their stock to the warmer districts of the Colony. The judges, who were the Hon. Arthur Fuller, Minister for Agriculture, Cape Colony, and Mr. McNab, the Orange River Colony Wool Expert, had a short task which, at the same time, caused them considerable trouble. In one or two cases the owners had entered their animals in the wrong classes, and the judges very considerately exercised their right to transfer the entries to the proper class. The prize for the best imported ram, 4-tooth and over, was won by Mr. C. F. Labuschagne; while Mr. Theo. Moller won the awards for the best South African bred ram, 4-tooth and over, and also the premier place for the best robust wool.

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The pig exhibit was the best we have seen in the Transvaal, the Yorkshires and Large Blacks belonging to Mr. S. C. Skaife eliciting universal praise, whilst one of the most disappointing features of the whole show was the poultry section. The number of entries, 327, was far below what was confidently expected. After the terrible havoc caused by the locusts, a first-class exhibit of vegetables and farm produce was not to be expected, but if the amount was small it was of exceptionally fine quality. The exhibits of South African manufactures were most promising and full of interest.

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In perusing the prize list we were disappointed to observe that there was no class for Boer horses, more especially when we recall the efforts made by the Department of Agriculture to assist in the establishment of a superior type of this breed. A substantial premium might well have been offered to encourage farmers to bring forward an animal which, for staying power, is unequalled in the whole country. Moreover, a special prize for the best collection of grasses, native and imported, would tend to create an interest in our fodders. A single example will serve to illustrate this remark. Two years ago, Mr. A. H. Malan, of Standerton, got half-a-pound of teff grass from the Division of Botany. This season he has cut 25 waggon-loads of hay and secured, as well, 200 lbs. of seed of this teff.

A word of suggestion may not be out of place. There was little or no classification, and, consequently, certain of the exhibits were difficult to find. In a show of the magnitude of the Witwatersrand Agricultural Society there are a thousand and one things to be looked after, and it is easy to find some small sins of omission and commission here and there, but we may rest assured that the energy and enterprise for which the people of the Golden City are justly renowned will remove the reproach of any want of organisation, precision, or method before this time next year.

Zoutpansberg.

The third annual show of the Zoutpansberg Agricultural Society was held on Wednesday, May 22nd, and was opened by Mr. F. B. Smith, Director of Agriculture. In some ways, the show was rather a disappointment, the number of entries throughout being small. Cattle were poorly represented, the reason being that the greater portion of the Zoutpansberg district was still under quarantine, which rendered the transport of animals impossible. A fine Jersey bull was exhibited by Mr. G. G. Munnik, M.L.A. The poultry section was the main feature of the show; there were some hundreds of entries, and many of the birds were of a high quality. The tobacco exhibit caused a great amount of interest amongst the visitors, and certainly established the fact that Zoutpansberg is one of the foremost tobacco districts of the Transvaal. The quality was very good, and the care taken in preparing the exhibits was most gratifying. The exhibit from the Government Experimental Farm was one of the best that has yet been seen, and shows clearly the progress that has been made in the development of the tobacco industry at Tzaneen.

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Another feature of the Tzaneen exhibit was cotton, which was a remarkable testimony to the suitability of the Northern Transvaal for this kind of culture. A private exhibit of the same class was made by Messrs. Dicca Bros.; this was of a similar nature to samples which have already been sent to Europe for a report by this firm, concerning which the experts of the Imperial Institute and the British Cotton Growers' Association stated that the cotton was quite equal to the same produce of America.

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The exhibit of Mr. Gadd of Persian sheep was of a fine quality, as was also his pen of wild ostrich chicks. The feathers of these birds were considered by those capable of passing an authoritative opinion to be of an excellent quality. And it is probable that, at no distant date, we may possess an ostrich farming industry in the Transvaal quite equal to that of Cape Colony. The result of this show has been to strongly support the opinion which is widely held, namely, that this northern region is one of the most fruitful in the whole world, and, given a system of railroads, would immediately become a province of vast and ever-increasing agricultural wealth.

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Stud Horse "Robur."

We take pleasure in directing attention to Plate CCXXXII., showing "Robur," a stallion of a rich bay colour with black points, foaled 20th January, 1902, belonging to Mr. Jordaan, of Wolmaransstad. This photograph was taken when "Robur" was three years old. He was the best of 100 foals bred by De Beers in 1902, and was exhibited by the De Beers Company at

Capetown, Port Elizabeth, and Grahamstown Agricultural Shows in 1904, obtaining first prize at each place as the best South African bred thoroughbred colt of two years; at Port Elizabeth, in addition to the first prize, he was awarded a fifteen-guinea gold medal. His height is about 15 hands; he is well ribbed and is a grand stayer. Having the oldest blood in his veins he should prove an excellent stallion to mate with the ordinary Boer mares of this country. The following is his pedigree:—

Sire.—Oakdene, bred by His Majesty the King, and bought by the late Rt. Hon. Cecil Rhodes for the De Beers Consolidated Mines.

Grandsire.—Donovan, winner of upwards of £55,000 in stakes.

Dam.—Shebaka, a pure Arab mare bred by Sir Wilfred Blunt, and purchased from him by the late Rt. Hon. Cecil Rhodes.

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Pedigree Africander Heifers.

In this issue our cover plate shows three pedigree Africander heifers, the property of the Transvaal Department of Agriculture. These animals won the first prize in their class at the Johannesburg, Bloemfontein, and Port Elizabeth Agricultural Shows.

Stud Horse "Robur."

CORRESPONDENCE.

This column will be devoted to correspondence, and an endeavour made to reply to all inquiries upon agricultural topics, or concerning any of the articles published from time to time in the *Journal*.

Correspondents will kindly write on one side of the paper only. No manuscript will be returned.

All letters must be addressed to the Editor of the "Agricultural Journal," Department of Agriculture, Pretoria.

A WOOL EXPERIMENT

To the Director of Agriculture.

Sir,—With the object of finding out to what extent it would be to the advantage of the Transvaal sheep farmer to class his wool and send it direct to the London market, according to the Australian methods, the following experiment was carried out with 349 Merino sheep imported from Australia. The total clip from these sheep (rams and ewes) was 4,277 lbs., making an average of 12¼ lbs. per sheep.

(2) The wool was dealt with as follows:—One bale of unclassed wool, consisting of some of the best fleeces, and two bales of bellies, locks, and pieces were sent to Durban to be disposed of in the Durban market. The 12 bales sent to London were specially classed. The following table shows the prices realised:—

Durban Prices

1 bale grease, 284 net lbs., @ 6½d.	£7 13 10
1 " bellies and pieces, 307 net lbs., @ 4¾d.	6 1 6
1 " locks and pieces, 174 net lbs., @ 4d.	2 18 0
	£16 13 4

London Prices.

6 bales 1st Comb. I. ..	676 net lbs.,	@	1s. 0½d ..	£87 5 10
1 bale 2nd " ..	257 "	"	11½d.	12 6 3
2 bales 1st pieces ..	580 "	"	11d.	26 11 8
2 " 2nd " ..	659 "	"	10d.	27 9 2
1 bale bellies	328 "	"	9½d.	12 19 8
12 lbs. samples	12 ..	..	.. .. ..	0 7 8
12 bales	3,512 net lbs.		.. .. ..	£167 0 3

For the purpose of comparing the prices per lb. obtained in each market, it is proposed to take the one bale of unclassed wool, which made 6½d. per lb. in Durban, and the 12 bales of classed wool, which in London made an average price of 11⅓d. per lb.

(3) The comparative cost of sending the wool to the two markets is shown in the following tables .—

Durban.

Railage, Kromdraai-Durban. 3 bales, 795 lbs. gross weight	£0	13	3
Commission	0	4	5
Insurance	0	0	6
Letting	0	8	0
	£1	1	2

Average cost for 765 net lbs., ⅓d. (one-third of a penny)

London.

Cost of sending 3,512 net lbs.—

Railage, Kromdraai-Durban, 3,652 lbs. gross weight	£3	0	5
Shipping in Durban and Insurance	2	2	9
Freight, Durban-London, 3,652 lbs. gross weight..	6	4	7
Dock Charges, London	2	8	0
Warehousing	0	4	6
Fire Insurance	0	3	6
Interest on Freight	0	1	2
Brokerage	0	16	9
Sale Expenses..	0	4	0
Commission	3	7	0
For 3,512 net lbs.	£18	12	8

Average cost, 1¼d. per lb.

If the trade were properly organised by the farmer, these charges could, of course, be reduced—one would hope to the usual 2 per cent., plus freight, which is the regular charge in Australia.

(4) The result of the experiment shows that unclassed wool, prepared for the market in the ordinary Boer way, fetched in Durban 6½d. per lb.; whereas the same wool properly classed fetched in London an average of 11½d. per lb. The difference in the cost of sending the wool to these two markets is as near as possible 1d. to the disadvantage of the London market. But this is amply compensated for by the extra price realised in London. In fact, had the highest price for unclassed wool paid in Durban been realised (8¾d. per lb.), the result would still have been in favour of the London market, as the following table shows :—

Average price realised in London	11½d.
Less cost of sending	1¼d.
	10¼d.
Highest price realised in Durban	8¾d.
Less cost of sending	⅓d.
Say ..	8½d.

The advantage in favour of the classed wool sent direct to the London market is, therefore, 1¾d. per lb.

Yours, etc.,

HUGH A. WYNDHAM.

P.O., Kromdraai,
near Standerton.

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ON THE SUCCESSFUL TRANSPLANTING OF LARGE TREES.

To the Editor of the Agricultural Journal.

In July last it became necessary, owing to alterations, to remove several large trees in Joubert Park, Johannesburg, and as some of these were good specimens, it seemed desirable that an attempt should be made to preserve them, and the effort was crowned with complete success.

The following is a list of the principal trees removed :—

Name.	*Girth.*	*Approx. Height.*
Castanea vesca (Chestnut, Spanish)..	37 in.	30 feet
,, ,, ,, ,, ..	28 ,,	28 ,,
,, ,, ,, ,, ..	26 ,,	24 ,,
,, ,, ,, ,, ..	21 ,,	19 ,,
Betula Alba	13 ,,	34 ,,
,, ,, (2)	8 ,,	18 ,,
Quercus pedunculata (10) ..	12 to 24 ,,	17 to 30 ,,
Cedrus Deodara	—	19 ,,

As the alterations were unforeseen, none of the trees, with the exception of the Deodar, underwent any preliminary preparation in the way of spring trenching.

The removals were from 20 to 50 yards, and were performed as follows :—The trees were trenched round at a distance of about 2 ft. 6 in. and to a depth of 3 to 4 ft. All large roots were carefully severed and the smaller fibrous roots retained. An inclined plane was dug out to the bottom of the trench and a sledge placed in position, on to which the tree with its full ball of roots and earth was gradually shifted by means of block and tackle. The largest of the Chestnuts must have weighed nearly three tons. The same process reversed was used in planting. The after treatment consisted of thinning out and pruning the heads of the deciduous trees to balance loss of roots, together with a thorough soaking immediately after planting and continued at frequent intervals, also repeated sprayings of the bark.

All the trees are living and are carrying nearly a normal crop of leaves (the Oaks are fruiting), while even the Birches and Deodar, usually difficult subjects for transplanting, show scarcely any signs of their removal.

It is evident from the foregoing results that, contrary to the general opinion, trees of large size can be successfully transplanted in this Colony during their resting period, provided that sufficient care is exercised in the shifting and that continuous attention be given to both watering and spraying, to which I largely attribute our success.

Yours, etc.,

ALEX. H. STIRRAT,

Superintendent of Parks.

Johannesburg.

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ON GALL SICKNESS IN CATTLE AND TICKS ON SHEEP AND GOATS.

To the Editor of the Agricultural Journal.

Sir,—This summer a great number of our cattle have been sick, the sickness lasting from four to eight days. We have treated for what is commonly called Gall Sickness (by drenching with Epsom Salts), although the symptoms are rather different to any cases of that disease we have had to do with. Moreover, 10 per cent. of the native cattle in this neighbourhood have suffered from the same complaint, but up to the present no cases have proved fatal.

The natives say they have not seen this sickness before and that it is not Gall Sickness, and all cattle drenched have recovered within 24 hours after dosing. The native cattle, which were not treated at all, have taken up to eight days to recover, meanwhile becoming very thin, as the animal refuses to eat anything whatever.

Symptoms.—The animal, without showing signs of being sick, stops feeding, and very soon becomes stiff in the forequarters, in some cases so much so that he cannot move. The neck is held straight down, the nose being within a foot of the ground, the animal absolutely refusing all food. The breathing is not affected in any way.

Should you recognise this disease we shall be glad if you would let us know what it is, the cause, and any treatment to prevent or cure.

With reference to Ticks :

Early last year I wrote to you with reference to ticks on the feet of sheep and goats, and asked for advice as to treatment. In your reply, you advocated clipping the ticks in half with scissors. It might be of interest to the readers of this "Journal" to know that by running the sheep and goats through a shallow dip about three inches deep, filled with the dip as per enclosed recipe, about once a week in the tick season, it will keep the sheep from becoming lame. The dip appears to kill by contact, so that the animals will not want to stand in, but merely walk through the dip. Should the ticks be clustered on the tails, which is commonly the case, an old paint brush and a tin full of the dip will fix them up.

Recipe for Dip.

1 gallon water.
2 lbs. arsenic.
1 lb. washing soda.
Boil and then add four gallons of water.

Should all the dip not be used, it will keep for any length of time.

Yours, etc.,
G. CRESSWELL & SONS.

Rocklands,
Naboomspruit Station.

Answer: It is not ordinary Gall Sickness, as many have supposed, neither is it due to climatic conditions or dietetic causes, as some have suggested, but is a specific disease which can be communicated by inoculation, and develops in the inoculated animal after an incubation period of six days. Mortality from this disease is extremely slight, and the treatment which you have adopted is really all that is necessary.

The tick dressing mentioned by you is, I have no doubt, very effective, but it is much stronger than is really necessary, and is open to the objection that it is exceedingly poisonous, and unless care is exercised in using it accidents are likely to occur.

A safer preparation, which you would find equally efficacious, would be the following:—

Arsenic	4 ozs.
Yellow Soap	1 lb.
Washing Soda	1 lb.
Stockholm Tar	1 quart.
Water	17 gallons.

Boil for six hours.

Use this in the same manner in which you use the dressing you are now using, or, if you prefer a still safer mixture, try the following:—

Stockholm Tar	1 pint.
Washing Soda	6 ozs.
Water	3 gallons.

Stirred well together.

Yours, etc.,

C. E. GRAY,
Principal Veterinary Surgeon.

* * * *

SALTING OF PORK, BEEF, AND HAM.

To the Editor of the Agricultural Journal.

Sir,—Would you kindly assist me with a little information on the following points:—

I have a salting syringe and would like to know the recipes for composing the fluid necessary for :—

1. Salting pork (hams, etc.)
2. Salting beef.
3. Salting and spicing pork.
4. Salting and spicing beef.

I would be extremely obliged for any information. Thanking you in anticipation.

Yours, etc.,

Amsterdam. F. A. ELLOR.

Answer: I am afraid that I cannot speak from much practical experience on the subject, beyond the ordinary methods of curing hams and bacon on the English farm.

In America, where the "salting syringe" or "pickling pump" is largely used, a liquid containing salt, saltpetre, sugar, and often boric acid is employed. A recipe often used is as follows :—

Common Salt	$5\frac{1}{2}$ lb
Saltpetre	$\frac{1}{2}$ lb.
Sugar	$\frac{1}{2}$ lb.
Boric Acid	$\frac{1}{2}$ lb
Water	2 gallons.

Other mixtures contain borax in addition to the ingredients mentioned.

As you are doubtless aware, saltpetre tends to make the flesh redder than it would be if salt alone were used.

Sugar tends to prevent putrefaction and probably lessens the hardening effect of salt, while boric acid or boracic acid has a great antiseptic power. Although the last mentioned is largely used in the preservation of meat (especially in America) and very generally in the preservation of milk, butter, cream, etc., its use is probably attended with a slightly injurious effect upon digestion. However, it is said that when boric acid partly replaces salt in the preparation of bacon, the product is softer, fresher, and more palatable.

For American pickled tongues a mixture of—

Coarse Salt	50 parts
Saltpetre	$\frac{1}{4}$ part
Borax	$\frac{3}{4}$ part

is used in the dry state.

As to spicing meat, I fear I cannot help you as this is largely a matter of taste. Cloves, pepper, nutmeg, and other spices are often used in addition to salt. Sometimes these are previously soaked in vinegar for some days and the liquid obtained added to the brine.

Trusting this information, though far from complete, may prove useful.

Yours, etc.,

Chemical Laboratory, HERBERT INGLE,
Department of Agriculture. Chief Chemist.

SNAKE BITE.

To the Editor of the Agricultural Journal.

Sir,—With reference to the letter on Snake Bites appearing in the April issue of the "Agricultural Journal," I may mention that the snake charmers of India attract snakes to them by playing on a flute made of a calabash or gourd; they also place milk about in shallow dishes, for the snake is a well-known lover of milk.

I have known a man recover from a cobra bite whose wound had been cut across several times with a pocket penknife, ligatures being bound in two places above the wound, the blood was freely squeezed out, and the wound severely cauterized with a stick of caustic. This was all very quickly done after the snake had bitten the man—in fact, while others killed the snake. That particular snake had been after the eggs in the house. We have killed four over five feet in length in South Africa in our hen-house, two actually swallowing eggs. Is it not possible to poison eggs in some way as a bait for them?

Yours, etc.,

Doornfontein. J. E. COLLINS-COOLING.

* * * *

FEVER CAUSED BY TAMPANS.

To the Editor of the Agricultural Journal.

Sir,—Thank you for the April issue of the "Agricultural Journal," in which I find a most interesting article on the tick (Tampan or Makarulu). I think you may be interested in my experience with this same tick a short time ago.

In January this year I had some transport work to do from the station to "Klopper Pan," taking out a boring machine, in company with two Europeans and three natives. We were unfortunate enough to have bad weather, and, being wet through all day, at night outspanned near a nice *clean looking* native hut and tied up the oxen. Then all hands went up; we cooked our supper and spread out our blankets on the floor, the natives sleeping by the fire. As we were tired and wet, we slept heavily, but about midnight I was very uncomfortable; I struck a match thinking there must be bugs or ants in our blankets (from the hut), but I found simply swarms of the tick described as Tampan. We had all been thoroughly bitten, and could not sleep any longer. The next day we got the natives to overhaul our kits and found everything swarming with the same tick. I put everything I had on and my kit in the river for seven days and got rid of them. I found in two days the first effects of these brutes. First, an almost unbearable irritation of the skin; second, big red blotches all over my body, and the fifth day I was greatly swollen and had a feeling of not wishing to do any work; on the eighth day I was down with fever; so was also my English companion, but the other comrade, a Boer, was only ill. I had fever off and on every 70 hours for six weeks, and lost so

much weight that I began to be uneasy, as, although I had a fever temperature, 102 to 103·50, I had some of the malaria symptoms. I have had malaria in Queensland, the Argentine, and Paraguay. I am sure that it was not the malaria I was used to have, as there were no shakes. I had to go into the Pretoria General Hospital for some time, and came out cured and have not had the slightest return since.

The natives showed no signs of having suffered more than the temporary inconvenience of loss of sleep for the night. The Dutchman was only ill and badly swollen and marked for about 16 days, but the Englishman has had constant attacks of malaria ever since, even up till to-day. This has been my first experience and I hope the last.

I send you this, not to take up your time, but just as a record of one living in this district, and also as a warning to those who do not yet know by experience what the Tampan is.

Yours, etc.,
H. G. GREENWAY

Zaagkuilsdrift,
Pienaars River.

* * * *

CO-OPERATIVE CREAMERIES.

To the Editor of the Agricultural Journal.

Sir,—In the January issue of the "Agricultural Journal," Judge Curlewis and another correspondent advocate in a very able manner the establishment of Government Creameries at Pretoria and elsewhere. The subject is of great importance, because without effective co-operation the unnecessary importation of dairy products will never come to an end. The amount of butter, cheese, and condensed milk imported into the Transvaal in 1906 came to £452,986. In order to show to our farmers what a small area is sufficient in other countries for the production of more than double that amount, I wish to point out a few facts relating to the dairy industry of the Algäu, a small district at the foot of the Bavarian Alps and extending well into the mountainous area.

The district is about 1,200 square miles in extent; this is equal to the distance from Johannesburg to Pretoria squared, and corresponds in area to 120 South African farms of 3,000 morgen each. More than third of the district is covered by forests and unproductive rocky and swampy ground. About half the area consists of well-cared-for meadows, which are improved by manuring and drainage to such an extent that 10 South African morgen will yield sufficient hay to sustain from 12 to 18 head of cattle all the year round. A farmer owning about 10 morgen improved meadowland (worth about £1,250) and, say, 15 cows is considered fairly well to do; in fact, the whole district is one in which great poverty is hardly known.

The district produces annually 2 millions hectolitres milk of a value of 20 million marks, which is equal to 266 million bottles at 10½ francs per dozen bottles—or one million pounds sterling. Few of the farmers turn the milk themselves into butter or cheese; there are more than a

thousand creameries that either work on the co-operative principle or buy the milk right out at something less than one shilling for a dozen bottles. The manufacture of cheese (which we buy here under the names of Gruyere, Limburg, Camembert, etc.) absorbs the principal portion of the milk. Butter is more or less a bye-product in the manufacture of soft cheeses. The condensed milk which is sold here with the milkmaid brand is manufactured in the district in an enormous establishment.

The cattle bred in the district are of a very hardy class, known as the Simmenthaler type. They have been introduced with great success to German South-West Africa, the Cameroons, and East Africa. The yield in milk is not so heavy as is the case with the Friesland cattle, but the milk is richer. The average yield per cow all the year round (counting also the dry cows) is 8 litres, equal to about 11 bottles per day. One hundred litres (135 bottles) of milk give 9 lbs. of butter, which, with the value of skimmed milk, would bring in about 12 shillings.

The meadows are cut twice a year; in particularly good seasons a third cutting can be made. Only after the last cut the cattle are allowed to graze in the meadows. For this reason, and owing to the severity of the winter, the cattle are stabled for eight to ten months in the year, excepting in mountainous districts, in which they are allowed to graze from May to October. An enormous quantity of hay must thus be stored, and the constructors of the farmhouses make provision for large storage space. The stable is under the same roof as the dwelling portion of the house. Under the stable floor there is a cemented tank in which all the excrement of the cattle is carefully collected. Where the nature of the ground permits it, the liquid manure is led by means of a pipe to the rear of the stable into wooden or iron tanks on wheels, in which it is ridden out to the meadows. On the western side of the stable, with a large projection so as to form a farm-yard well protected from the cold winter storms, a large barn, built of wood, is added. In this the ground floor is used for keeping vehicles and agricultural machinery; the top floor serves for the storage of hay and other agricultural produce.

All these arrangements are, of course, necessitated by a particularly severe climate; they would not answer in our more favoured zones. I only wish to show what can be attained under difficult circumstances, and to point out that it can be done only by *co-operation*. If the advantages which cheaper land and a more genial climate give us were combined with an effective system of co-operative dairying, the produce of the district described could never compete with our own local dairy products, just as in like manner it is already partly beaten by our imports from Australia.

Yours, etc.,

Johannesburg. KARL F. WOLFF.

DEPARTMENTAL NOTICES.

AVAILABLE PUBLICATIONS.

The following publications, amongst which are included several recent additions, can be had, free of charge, on application to the Government Printer, Box 373, Pretoria :—

Transvaal Agricultural Journal, No. 3, Vol. I. (Published quarterly).
" " " No. 4, Vol. I. " "
" " " No. 10, Vol. III. " "
" " " No. 13, Vol. IV. " "
" " " No. 14, Vol. IV. " "
" " " No. 15, Vol. IV. " "
" " " No. 16, Vol. IV. " "
" " " No. 17, Vol. V. " "
" " " No. 18, Vol. V. " "
" " " No. 19, Vol. V. " "
" " " No. 20, Vol. V. " "

Division of Botany:—
Leaflet No. 1.—"Plants Poisonous to Stock."
" No. 4.—"The Cockle-Burr" (English and Dutch).
Bulletin No. 1.—"The Conditions of Seed and Plant Distribution."
Circular No. 1.—"Poisonous Plants" (English and Dutch).

Division of Entomology:—
Leaflet No. 7.—"The Spraying of Locusts" (English and Dutch).
" No. 3.—"White Ants."

Division of Forestry:—
"Price List of Seeds and Trees" (English and Dutch).

Division of Horticulture:—
Bulletin No. 1.—"Some Information about Fruit Trees" (English and Dutch).
Leaflet No. 1.—"On Summer Pruning" (English and Dutch).
" No. 2.—"On Thinning Out Fruit."
" No. 3.—"A Fruit Report" (English and Dutch).
" No. 4.—"Diseases of Orange Trees" (Dutch and English).

Division of Publications:—
Bulletin No. 1.—"Burrweed or Boete Bosch."
" No. 2.—"Some Diseases of the Horse."
" No. 3.—"The Food of Plants."
" No. 6.—"City and Town Milk Supply and the Care and Aeration of Milk" (English and Dutch).

Division of Veterinary Science:—
Bulletin No. 1.—"Measles in Swine and Cattle" (English and Dutch).
" No. 6.—"Contagious Abortion" (English and Dutch).
Leaflet No. 3.—"Rhodesian Tick Fever" (English and Dutch).
" No. 5.—"Glanders and Farcy."
" No. 6.—"Directions for Preparing Blood Smears." (Dutch.)

Miscellaneous:—
Transvaal Forest Report.
Agriculture within the Empire.
Bulletin No. 1.—Department of Irrigation and Water Supply: "The Design and Construction of Small Reservoirs for Irrigation and for Stock."
" No. 2.—Department of Irrigation and Water Supply: "The Design and Construction of Small Irrigation Canals."
" No. 3.—"The Brands Directory, 1906."
Annual Report of the Director of Agriculture for the year 1903-04.
" " " " " 1904-05.
" " " " " 1905-06.
Regulations for Preventing the Introduction and Spread of Insect Pests and Plant Diseases in this Colony.

JOURNAL FILES.

In order that our numerous readers may not be disappointed by being unable to complete their files, we would earnestly request them to preserve all copies of the "Journal" if they propose to bind them at the close of the year. Owing to the expense incurred in publication, it has become necessary to limit the number of copies issued, and it often happens that we cannot supply back numbers, as they are out of print.

Indices for the "Agricultural Journal," Vol. I., Vol. II., Vol. III., and Vol. IV., can be had on application to the Department of Agriculture.

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JOURNAL DUPLICATES.

Any readers who possess and can spare duplicates of the "Agricultural Journal" would confer a great favour by returning them to the Department of Agriculture, as back numbers are now out of print, and applications are constantly being made by persons desirous of completing their sets.

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ADDRESS.

Correspondents are earnestly requested to give their full name and correct postal address when forwarding any communication to the Department. It sometimes happens that readers send their farm address only, and fail to give the Post Office address, consequently it is impossible to reply to their queries or send publications. This refers more especially to farmers applying for cattle permits, as in many cases letters forwarded by the Veterinary Division are returned by the Postal Authorities to the effect "Not delivered. Address insufficient." The Department should also be immediately notified of any change of address.

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APPLICATIONS FOR THE "JOURNAL" AND NON-DELIVERY.

Applications to be placed on the Mailing List of the "Journal," as well as complaints as to non-delivery of the "Journal," should be addressed to the Government Printer, P.O. Box 373, Pretoria, and not to the Editor of the "Journal." It is particularly requested that changes of address should also be promptly notified to the Government Printer, in order to ensure prompt delivery to addressees and to avoid unnecessary correspondence.

The "Agricultural Journal" is distributed free in the Transvaal only, and the attention of subscribers in the other South African Colonies and Oversea is kindly requested to the Government Printer's Notice on the tinted page at the commencement of this number.

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TOBACCO PLANT DISEASES.

A large number of letters and verbal inquiries have been received by the Tobacco Division in regard to diseases and insects injurious to tobacco plants. It is impossible to give any reliable advice as to remedies for different diseases and insect pests unless a specimen of the affected plant is forwarded to us, and our readers are, therefore, requested to furnish a portion of the affected plant when writing for advice in such matters. Most of the diseases and insect pests which attack tobacco plants in the Transvaal are easily controlled. Letters, but not parcels, may be sent free of charge if addressed as follows:—

O.H.M.S.

Mr. J. van LEENHOFF,
Government Tobacco Expert,
Department of Agriculture,
Pretoria.

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*GOVERNMENT STALLIONS FOR PUBLIC STUD.

Applications to hire stallions for next season should be made before July 15th on which date these applications will be considered.

As the number of stallions is limited, preference will be given to owners of the best class of mares.

TERMS.

Stallions will be leased to individuals, associations, or two or more breeders in conjunction, approved of by the Department.

The Lessee or Lessees to allow the farming public to send mares for service at a fixed fee, provided the list is not already full, the fees to be according to the following tariffs, viz.:—

Prices paid for Hire of Stallion.	*Fee to be charged by Lessee not to exceed*
£25	30s.
£30	35s.
£40	45s.
£50	55s.
£60	65s.

The charge for the hire of the majority of the stallions will range from £25 to £35, but for a few exceptionally high-class animals somewhat higher rates will be made.

Payment for hire of stallions to be made in advance.

Not more than 40 mares to be served by a stallion without written permission.

Stallions will be delivered by the Department at the nearest railway station to the place where they are to stand at stud, and expense of railage will be borne by the Department. At the termination of the season the stallion will be taken over by the Manager of the Government Stud Farm, or his representative.

Stallions will not be allowed to run with mares unless by special arrangement.

Due care must be taken that stallions shall not serve mares suffering from any contagious diseases.

The Manager of the Stud Farm or his representative to have the right to inspect the stallions leased at any time.

In the event of a stallion dying during the period for which he has been leased, from any cause through which the lessee is to blame, the lessee will be liable for a sum equal to the price already paid for the hire of the same.

The lessee to be responsible for the good care and attention of the stallion and his equipment.

Should any of the foregoing rules not be complied with, the Department shall have the right to remove the stallion at once, and to take any action desirable for the recovery of damages, the lessee to forfeit the money paid for hire.

Applications must be addressed to the Manager, from whom any further information can be obtained.

F. B. SMITH,
Director of Agriculture.

A. McNAE,
Acting Manager.

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DIVISION OF FORESTRY.

Tariff for Poles and Firewood from Groenkloof Plantation, Pretoria.

It is notified for general information that the Groenkloof Plantation having been transferred to the Municipality, all applications and correspondence in connection therewith should be addressed to the Town Engineer, Pretoria, and not to the Department of Agriculture.

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PRICE LIST OF TREES AND SEEDS.

The price list of trees and seeds supplied by this Division, which was printed in full under "Department Notices" in the last number of the "Journal," has now been issued as a separate publication, and can be obtained free of charge, on application to the Conservator of Forests, or the Government Printer, Pretoria.

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NOTICE No. 542 of 1906.

Grants-in-Aid of Tree Planting.

It is hereby notified that the Government is prepared to contribute towards the expenses of Tree Planting, undertaken by Municipalities, Agricultural Societies, and other Public Bodies.

The conditions under which the grant will be made are:—

(1) There shall be submitted to the Director of Agriculture for approval, as soon as possible after the 1st of July in each year, a plan of the place or places or streets where it is intended to plant, a list of the kinds of trees to be planted, and also an outline of the methods to be employed in preparing the ground for the trees and for protecting them. The total number of trees to be planted and the total estimated cost should be stated.

(2) The completed work shall be inspected and compared with the approved working plan, and for any unauthorised departure from the plan submitted to be approved by the Director of Agriculture a deduction may be made from the expenditure account.
(3) Street trees shall not be planted on the pavement or furrow or be spaced nearer than 15 feet apart. They must be securely fenced.
(4) Different kinds of trees shall not be mixed.
(5) Plantations shall be protected against fire.
(6) A separate account shall be kept of all monies expended on tree planting, and shall always be open for Government inspection, and a statement of accounts signed by the Chairman and Secretary and countersigned by the local Magistrate shall be submitted to the Director of Agriculture not later than the 1st of June in each year, so that the grant may be paid before the end of the financial year (June 30th).
(7) On approval of the Director of Agriculture, or his Deputy, of the work undertaken, and of the accounts for the same, a sum (not exceeding £100 for any one body) equal to half the total expenditure incurred in tree planting shall be refunded to the Municipality, Agricultural Society, or other Public Body concerned.
(8) As the money available for this scheme is limited, applications will be dealt with in the order in which they are received, till the whole sum has been allotted.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture,
Department of Agriculture,
Pretoria, September, 1906.

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DIVISION OF BOTANY.

Seed Distribution.

A list of seeds available for farmers who are willing to conduct experiments in co-operation with the Division has been published as Bulletin No. 1, and may be obtained on application to the Government Printer. Terms on which the seeds will be issued are stated in the Bulletin, and application forms will be found within the cover. Notes are given as to the uses of the plants and as to how the seed should be treated.

Cockle-Burr.

On account of the dangerous character of this weed to wool and mohair growers, farmers on the Aapjes, Pienaars, and Crocodile Rivers are advised to keep a sharp look-out for its appearance, especially on the banks of the rivers, and to root out the plants before they go to seed. Any farmer who is in doubt as to the identity of Cockle-Burr can send specimens to the Botanist for identification.

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DIVISION OF CHEMISTRY.

Instructions for the Sampling of Soils.

In taking soil for analysis, it is of the utmost importance that a truly representative sample be secured, otherwise the labour involved will, to a great extent, be wasted.

Much depends upon the particular object for which the analysis is to be made. If the soil of a farm or field is to be reported upon, and much difference exists in the soil from different parts, each variety of soil should be represented in the final sample by a quantity proportional to the aliquot portion of the whole area covered by that particular soil.

If great differences are known to exist in different parts of the farm or field, better knowledge of the nature of the soil will be obtained, of course, at the cost of greater labour in analysis, if the samples are kept separate.

The *depth* to which a sample is taken is also a matter of importance. In some cases a clear line of separation between the soil proper and the sub-soil is perceptible. This is often shown by difference in colour, the soil being richer in organic matter, and therefore darker than the sub-soil. Under such circumstances the sample of soil should be taken down to the line, and, if necessary, a sample of sub-soil should also be secured. When no distinction is perceptible, the sample should be taken to the depth of one foot.

Methods of Taking Samples.

There are many ways of taking samples of soil. The following, perhaps, will be found most convenient in this country:—

(1) Having selected a representative spot, the vegetation upon it is removed, and a hole is dug with a sharp spade to a depth rather greater than that of the soil proper, or, if no line of separation of soil from sub-soil is perceptible, to about 15 inches. One side of the hole is then trimmed with the spade so as to be smooth and vertical, the hole being cleaned out. A slice of uniform thickness, about 3 or 4 inches, is then removed by the spade down to the necessary depth. This slice is placed on a clean board or sack and mixed with similar slices, obtained in the same way from other parts of the field. Finally, all the samples are thoroughly mixed together with the trowel or the spade, the sticks, large stones, and roots removed, and a portion of six or seven pounds placed, with a label giving details, in a clean box and sent for analysis.

(2) Another, better but more laborious, method is to have wooden boxes, 6 inches square and 12 inches deep, to hold the samples. A large hole is dug with a spade at the selected spot, and a square upright block of soil is left in its centre. This is carefully trimmed with the spade until a box will just fit over it. The upper surface of the block of soil is freed from vegetation, the box inverted over it, and forced down. The spade is next slipped under, and the box with its contents removed, a label giving particulars of the soil put in, and the lid screwed on. In this way a sample of the soil (and often the sub-soil, *in situ*) is obtained, which can be examined in the laboratory.

What to do with the Samples.

In all cases full details as to the exact locality, date of collection, depth, crops borne, previous manurial treatment, and other circumstances connected with the soil should be enclosed with the sample. These should be written in pencil, as ink is apt to become damp and run.

Samples should be sent by passenger rail, addressed to me at the Agricultural Chemical Laboratories, Pretorius Street, Pretoria, and advice of their despatch, together with details of the samples, should be sent by post to the same address.

While every effort will be made to deal with the samples as soon as possible, for a time, at least, some delay may be unavoidable, owing to the large accumulation of material awaiting analysis. *No attention will be paid to samples sent without the full details stated above.*

A list of charges for the analysis of soil and other products is published below, but in cases where it is considered that the results may be of sufficiently general interest, if published, no charge will be made.

HERBERT INGLE,
Chief, Division of Chemistry.

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SCHEDULE OF CHARGES FOR ANALYSIS MADE IN THE AGRICULTURAL LABORATORIES.

	£	s.	d.
1. Estimation of one constituent in a manure or feeding stuff	0	7	6
2. Estimation of two or three constituents in a manure or feeding stuff	0	15	0
3. Complete analysis and valuation of a manure or feeding stuff	1	0	0
4. Analysis of water—drainage or irrigation	1	5	0
5. Partial analysis of a soil to determine fertility and manurial needs	2	0	0
6. Complete analysis of a soil	3	0	0
7. Analysis of milk, cream, butter, or cheese	0	10	0
8. Milk—determination of fat and total solids	0	5	0
9. Milk—determination of fat only	0	2	6
10. Butter—determination of water and fat	0	5	0
11. Analysis of a vegetable product—hay, ensilage, roots, etc.	1	0	0

At present no charge will be made to *bona fide* farmers. The charges in the above schedule refer to products sent by manure merchants, milk dealers, or others interested in trade. Samples will only be accepted if assurance can be given that they are properly taken and truly representative of the bulk. The right of publishing the results of any analysis is reserved by the Department. Should the examination of any product furnish results which are deemed of sufficient general interest, the charges may be remitted.

Samples of any product likely to be of agricultural importance will gladly be received.

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SPÔNZIEKTE OR QUARTER EVIL.

Vaccine for the prevention of this disease is now ready for issue at the Government Veterinary Bacteriological Laboratory, and can be obtained through the Government Veterinary Surgeons, who will give instruction in the method of vaccination, and through whom also the necessary instruments can be obtained. The price of the vaccine is 3d. per double dose.

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LIST OF OFFICIALS.

The following is a list of the officials of the Transvaal Department of Agriculture, to whom inquiries respecting matters connected with agriculture may be addressed:—

Director	F. B. Smith.
Assistant Director	A. C. Macdonald.
Division of Veterinary Science:	
(*a*) Bacteriology	A. Theiler.
(*b*) Contagious Diseases	C. E. Gray.
Division of Chemistry	Herbert Ingle.
Division of Botany	J. Burtt-Davy.
(*a*) Plant Pathology	I. P. Pole-Evans.
(*b*) Seed Introduction and Plant Experiments	H. G. Mundy.
Division of Forestry	Charles E. Legat.
Division of Entomology	C. W. Howard (Act.)
Division of Horticulture	R. A. Davis.
Division of Tobacco	J. van Leenhoff.
Division of Publications	William Macdonald.
Division of Poultry	Reginald Bourlay.
Government Stud Farm, Standerton	A. McNae
Government Experimental Farm, Potchefstroom	Alexander Holm.
Government Experimental Farm, Ermelo	H. Nicholson.
Government Experimental Farm, Tzaneen	H. S. Altenroxel.
Translator	Otto Menzel.
Registrar of Brands	J. J. Pienaar.

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SUMMARY OF DEPARTMENTAL INSTRUCTIONS FOR THE GUIDANCE OF STOCK INSPECTORS AT TRANSVAAL PORTS OF ENTRY.

(*Animals will be inspected only between the hours of sunrise and sunset.*)

No. 1.—Cattle.

No cattle will be admitted into the Transvaal by road or rail unless the owner has previously applied for and obtained a written permit from the Department of Agriculture, Pretoria. This permit must be presented to the Stock Inspector along with the animals at the Ports of Entry specified in the permit.

In making application for this permit the following particulars must be furnished:—Name of owners; locality from which the cattle come; purpose for which they are being introduced; number of animals to be introduced (if coming by rail: station at which they are to be trucked; station at which they are to be derailed); name of consignee and ultimate destination of the animals. These particulars are required for the information of the Advisory Committee of the Ward or District into which the cattle are to be introduced, by whom all permits have to be recommended before they are issued.

SLAUGHTER CATTLE will be branded at the Port of Entry with the brand  *on the left side of the neck before proceeding to their destination if this has not been already done by the consignor before shipment.*

No. 2.—Equines.

All persons introducing equines into the Transvaal must produce certificates for their animals signed by a qualified Veterinary Surgeon holding the Diploma of the Royal College of Veterinary Surgeons, England, stating that the animals are free from disease and that they have been tested with mallein and have reacted in a normal manner. These certificates will be collected by the Stock Inspector at the Port of Entry. If any horse is presented for admission without a certificate it will either be tested with mallein by the Stock Inspector and allowed to enter after the Inspector is satisfied that the animal is free from disease, or it may be allowed to proceed to its destination and tested there, whichever course is most convenient for the Department.

Exceptions.

Equines which are engaged in to-and-fro movements across the border. Equines which have recently come from the Transvaal and are returning thither.

Racehorses in training will be allowed to proceed to their destination upon the owner giving an undertaking to report their arrival to the Government Veterinary Surgeon of the District, and to submit the imported animals to the mallein test if the Government Veterinary Surgeon considers this necessary. All other equines will be detained and tested unless the owner has previously made other arrangements with this Department.

No. 3.—Sheep.

Sheep are subject to examination at the Port of Entry and liable to detention if found affected with scab.

No. 4.—Pigs.

Pigs from Cape Colony are now allowed to enter the Transvaal if the following conditions are observed:—The person desiring to introduce swine into this Colony from Cape Colony shall make application to the Director of Agriculture, Pretoria, stating the place from which and the person from whom the swine are being obtained, and giving particulars as to their number, destination, and the purpose for which they are being introduced; he shall further submit with such application a certificate signed by the Chairman of local authority of the district from which the animals are to be brought and endorsed by the Chief Veterinary Surgeon or his representative to the effect that such swine are free from swine fever, and that there has been no swine fever in the place from which they have been immediately obtained.

Upon receipt of such documents the Director of Agriculture may grant and transmit a permit authorising the introduction of such swine. Such permit shall be sent with the animals, and shall be handed over to the Stock Inspector at the Port of Entry.

Permits for the introduction of pigs from other Colonies are not required.

C. E. GRAY,
Principal Veterinary Surgeon.

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WARNING TO IMPORTERS.

The attention of the Department has been directed to the fact that certain imported cattle brought into this country under certificates stating that they have been tested with Tuberculin before shipment and have passed the test satisfactorily, have been found to react as infected when re-tested by the Government Veterinary Staff shortly after arrival. For this reason it is suggested that importers of cattle should have such imported animals re-tested by a Government Veterinary Surgeon on arrival at their destination, and before they are allowed to mix with other stock. Should anyone wish to take this precaution the test will be applied free of charge upon application to the Government Veterinary Surgeon of the District to which the cattle are taken, at the earliest convenience of this Officer to whom the application is made.

F. B. SMITH,
Director of Agriculture.

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NOTICE.

It is hereby notified for general information that the Department has been advised by the Commissioner, Nairobi, British East Africa, that sheep and goats

may now be imported from the South African Colonies into British East Africa if accompanied by a Veterinary Certificate certifying that the animals are in good health.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture,
Pretoria, October 1st, 1906.

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POISONOUS PLANTS.

The Division of Botany and Division of Veterinary Science are carrying on a series of joint investigations on the poisonous plants of the Colony, their effect on stock, and the remedies to be applied.

Last year we invited farmers to send specimens of poisonous plants for identification and are glad to be able to extend the invitation this year.

Any farmer who has poisonous plants on his farm, and would like information about them, may send samples to the Department for investigation. These samples will be identified and named, will be tested on animals kept for the purpose, the symptoms will be carefully diagnosed, and different remedies will be tested. A report of the results will be sent to the person furnishing the specimens.

For an effective test, samples of at least 5 lbs. of the material should be sent, but smaller samples will also be welcome for identification and preliminary report.

Through the courtesy of the Postmaster-General, specimens may be sent by post, free of charge, if fastened up as letters and addressed:—

O.H.M.S. Letter Post.
The Government Botanist.
Department of Agriculture,
P.O. Box 434,
Pretoria.

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CO-OPERATIVE EXPERIMENTS: COTTON.

Cotton Seed Donated by the British Cotton Growing Association.

The Department has received a large consignment of American Upland Cotton Seed from the British Cotton Growing Association. This seed will be distributed to any *bona fide* farmer who wishes to give the crop a trial, in sufficient quantity to sow one acre (209 x 208 English feet).

The amount of seed required will be as follows:—

For the Low Veld, sowing 4 x 3 feet, 3 lbs. of seed.
„ Middle Veld „ 4 x 1½ „ 5 to 6 lbs. of seed.
„ Middle Veld „ 4 x 1 „ 7 to 9 lbs. of seed.

(The thicker sowing is advisable at higher altitudes where the climate is rather cooler.)

The farmer is required to pay all carriage and transport charges from Pretoria to his farm (freight from America to Pretoria has been paid by the Association and the Department).

The farmer must sign and return the attached form of agreement either to the Government Botanist or to the Resident Magistrate.

This agreement is made necessary by the conditions under which the Association has supplied the seed. These conditions read "That all the cotton grown from this seed shall be shipped to the Association for sale, and if the experiment proves successful the cost of the seed shall be refunded to the Association, that other experiments may be conducted; . . . if the experiments are a failure they (the farmers) will be called upon to pay nothing; if successful, the Association will dispose of the cotton for their account, and deduct the cost from the proceeds."

The Association has agreed to supply the Department with two hand-gins, which we intend to loan out to each district. Application for the use of these gins should be made in due course to the Resident Magistrate.

A pamphlet entitled "Hints on the Cultivation and Harvesting of Cotton," has been issued by the British Cotton Growing Association, a few copies are still available, one of which will be sent to each farmer receiving seed, as long as the supply holds out.

For further information on Cotton Cultivation, etc., growers are referred to the articles and notes which have appeared in the "Transvaal Agricultural Journal" during the last 18 months, particularly the following:—

Cotton Growing in the Transvaal: "Agricultural Journal," No. 12, pp. 739-745. (July, 1905.)

Cotton as a Possible Crop for the Transvaal: No. 8, pp. 595-599. (July, 1904.)
How to Estimate the Yield of Cotton-lint per Acre: No. 9, p. 174.
Weight of a Bale of Cotton: No. 9, p. 174.
Transvaal Cotton; Reports from the Imperial Institute: No. 9, pp. 136-137; No. 11, pp. 554—556.
Cotton in South Africa: No. 9, pp. 130-131.
Transvaal Native Cottons: No. 9, p. 131 and pp. 136-137.
Cotton in the Low Veld of the Eastern Transvaal: No. 10, p. 316.
Zoutpansberg Cotton: No. 9, pp. 136-137; No. 11, p. 554.
Swaziland Cotton: No. 9, p. 137.
Cotton in the Marico and Rustenburg Districts: No. 12, pp. 863-864 and 842.
Cotton at Malelane: No. 13, October, 1905, pp. 152-155.

JOSEPH BURTT-DAVY,
Government Agrostologist and Botanist.

THE GOVERNMENT AGROSTOLOGIST AND BOTANIST,
TRANSVAAL DEPARTMENT OF AGRICULTURE,
P.O. Box 434,
PRETORIA.

CO-OPERATIVE EXPERIMENTS: COTTON.

SIR,

Please forward me by* ....
carriage forward, to ....Station, in care of ...., Forwarding Agents,. ....lbs. of cotton seed.

I agree to furnish you with a full and accurate report, at the end of the season, as to the results of the experiments, on the forms to be supplied by you.

In the case of the experiment being successful, I also agree to ship the whole of my crop of cotton to the British Cotton Growing Association for sale, and I will allow the aforesaid Association to deduct the cost of the seed from the proceeds thereof.

Date ....

Sign here ....

Two ....
witnesses. ....

Full P.O. Address ....
....

* * * *

GOVERNMENT NOTICE No. 242 OF 1906.

GRANTS-IN-AID OF AGRICULTURAL SOCIETIES AND OTHER SIMILAR ORGANISATIONS.

Notice is hereby given that for the purpose of assisting Agricultural Societies and other organisations formed for the promotion of the agricultural industry, the Government will be prepared to make grants-in-aid to such societies on the following conditions:—

1. Ten shillings for every £ raised by subscriptions, donations, and gate money, the proceeds of which are devoted to the ends specified above. No grants to be made against "value" contributions.

2. Special grants, when funds are available, against the costs actually and *bona fide* incurred in the future construction of buildings on, or other permanent improvements to, agricultural societies' grounds, provided that such buildings or improvements remain unalienated and vested in the Chairman or Secretary as trustee of the subscribers.

3. The Registrar of Deeds will be notified of all grants made under Clause 2, and will register same against the transfer of the property concerned.

4. The grants will be subject to the approval of the Commissioner of Lands, who will deal with the applications as they are received, fixing a maximum sum to be granted, if he deem necessary, having regard to the funds at his disposal, and the needs of the society concerned.

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* State whether the seed is to be sent by Passenger or Goods Train or by Parcels Post. If it is to be sent by Post, 8d. per lb. for postage should be enclosed with the application.

5. The Commissioner of Lands may alter the conditions under which any grant is made when, in his opinion, it is desirable to do so.

6. Grants will be paid annually on production of a statement of receipts and expenditure signed by the Chairman of the society or club, and bearing a certificate as follows:—

"I hereby declare the above to be a true and faithful statement of the receipts and expenditure of the ....during the period from ....to.......................and that no grant has already been claimed from the Government in respect of any portion of the receipts here shown."

Such declaration to be made before the local Magistrate or Resident Justice of the Peace, and who will also declare as follows:—

"I certify that to the best of my knowledge and belief the above statement is correct and that the society is entitled to a grant from Government under the conditions laid down in Government Notice No. 242 of 1906."

7. Claims intended for payment before the end of each financial year should be submitted not later than the 30th April.

They must be in respect of subscriptions and donations, etc., received during the twelve months ending on the 31st March of each year, and not prior to the commencement of that period, unless no claim has been made in the previous year.

8. Applications for grants should in all cases be forwarded through the local Resident Magistrate or Resident Justice of the Peace.

9. Copies of the audited balance sheet and the annual report of the society or club should be forwarded to the Department of Agriculture as soon as published.

A. C. MACDONALD,
Acting Director of Agriculture.

Office of the Director of Agriculture,
Pretoria, 5th March, 1906.

* * * *

EXPERIMENTAL FARM, POTCHEFSTROOM

SEEDS FOR DISPOSAL.

POTATOES.

Price 15s. per bag of 160 lbs nett f.o.r. Potchefstroom subject to alteration without notice.

The following varieties, after having been tested on this farm are recommended, and "seed" thereof will be ready for disposal. Early and medium early varieties, from July to September. Late varieties, from September to November.

Size of Tubers Medium large and seed size mixed.

Varieties —First crop from imported seed, and dipped in Formalin solution to prevent "scab."

Very Early.

Snowdrop
Early Puritan
White Hebron.

Early.

Early Rose.
Beauty of Hebron.
Epicure.

Medium Early.

Sutton's Flourball
Red Skin Flourball.
Sharpe's Express.
British Queen.

Late.

Five Towers.
Up-to-date
Diamond.
Invincible.

Very Late.

Scottish Triumph.
Langworthy.
African Red

Note. —The very early varieties yield smaller crops than the others. Their value consists in their very early maturity.

MEALIES (MAIZE).

Price 20s per 100 lbs., f.o.r. Potchefstroom.

The following varieties, after having been thoroughly tested on this farm, are recommended. The kind of climate and the district in which the mealies are planted is the chief factor which determines the varieties which are suitable for that district.

Applicants who are not acquainted with the characteristics of the different varieties are recommended to leave the selection to the undersigned, who will forward seed of those

varieties which are likely to give the best results in the district in which they are to be planted.

Colour.	*Name of Variety.*	*Maturation.*
WHITE :—	Virginian Horsetooth.	Late
	Hickory Horsetooth.	Late.
	Improved Early Horsetooth.	Medium late.
	Hickory King (8 and 10 rowed).	"
	Iowa Silver Mine.	Medium.
	White Cango	"
	Wisconsin White Dent	Medium early.
	Wood's Northern White Dent.	"
	Champion White Pearl	"
	Thoroughbred White Flint.	Early
YELLOW —	Yellow Horsetooth.	Very late
	Golden King	Late
	Yellow Hogan.	"
	Austen's Colossal Yellow Dent.	"
	Yellow Flint.	"
	King of the Earlies	Medium early.
	Early Star Leaming	"
	Eureka Field Corn	"
	Drought Proof Yellow Dent	"
	Hundred Day Bristol	"
	Chester County Mammoth.	Early.
	Extra Early Huron Dent	"
	Ninety Day	"
PALE YELLOW	White Cap Dent	"

The whole of the seed offered is shelled from carefully selected and hand-picked cobs, true to the type and character of each variety The greatest care is taken to ensure uniformity in the seed by "topping" and "tailing" the cobs, and by hand-picking Some varieties are inclined to be unstable in their characteristics, and in other cases the effects of cross-fertilisation may not be apparent

These conditions have been reduced to a minimum, as far as care in the growth and selection of the seed will permit.

SORGHUM (SACCHARATUM)

Price 3d. per lb, f.o r Potchefstroom

Recommended for ensilage Sow 12 to 15 lbs per acre

BROOM CORN

Price 3d per lb, f o r Potchefstroom

Recommended for growing material required for making brooms Sow about 8 lbs per acre.

TEFF.

Price 1s per lb, f o r Potchefstroom

An excellent quick-growing grass, very suitable for hay Sow about 2 lbs. per acre.

MANNA (BOER)

Price 6d per lb, f o r Potchefstroom.

A robust growing variety of good quality Sow 10 lbs per acre.

As it is desired to distribute these seeds as widely as possible, the quantity of each variety which can be sold to individual purchasers will depend upon the applications received Applications should be sent as early as possible, and orders must be accompanied by postal order or cheque in favour of General Manager, Experimental Farm, Potchefstroom, from whom any further particulars may be obtained.

ALEX HOLM,
General Manager.

* * * *

EXPERIMENTAL FARM, POTCHEFSTROOM.

STALLION FOR PUBLIC STUD.

The "Clydesdale" Stallion "Transagric," sire Royal Chief (10,876), dam Minnie (Vol. 28), by Baron's Pride (9,122), grand dam Brenda II. (12,871), by Macgregor (1,487), will stand at Stud at the Experimental Farm, Potchefstroom, at the service fee of £2 2s., payable at the time of service.

"Transagric" won the gold medal at the Johannesburg Show of the Witwatersrand Agricultural Society, 1907, for the best Clydesdale exhibited. He is a black horse, about 16 hands 1 inch, on strong and short limbs, and full of substance and quality. He is recommended for breeding horses for van or draught purposes.

Arrangements can be made with the General Manager, Experimental Farm, Potchefstroom, for mares to remain at the farm during the service season at reasonable charges for keep and attendance.

ALEX. HOLM,
General Manager.

* * * *

SOME RECENT ADDITIONS TO THE REFERENCE LIBRARY OF THE DEPARTMENT.

Cape Colony.

Industries of the Cape Colony. Department of Agriculture, Cape Town, 1907.

Natal.

Agricultural Industries and Land Settlement of Natal, 1907.—Agricultural Department, Pietermaritzburg, 1907.

Orange River Colony.

The Orange River Colony Its Resources and Development.—Department of Agriculture, Bloemfontein, 1907.

Rhodesia.

Handbook of Rhodesia.—B.S.A. Co., London, 1907.

Transvaal.

Annual Report of the Director of Agriculture for 1905-6.
Transvaal Government Handbook of the South African Products Exhibition, 1907.

Great Britain.

The Book of the Pig. Jas Long. L. Upcott Gill, London, 1906. 2nd Edition.
The Modern Peach Pruner. Bréhaut. Journal of Horticulture Office, London, 1866.
The Horse Breeders' Handbook.—J. Osborne. (Published by the Author), London, 1889.
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Plant Geography upon a Physiological Basis. Schimper. The Clarendon Press, Oxford, 1903.
The Naturalist on the Amazon.—H W. Bates. John Murray, London, 1895.
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The Principles of Stratigraphical Geology. -J. E Marr. University Press, Cambridge, 1905.
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The Culture of Fruit Trees in Pots.—J. Brace. John Murray, London, 1904.
Plants and their Ways in South Africa.—Stoneman. Longmans, Green & Co., London, 1906.
The Chemistry of the Garden.—Cousins. Macmillan & Co., London, 1906.
Flesh Foods, with Methods for their Chemical, Microscopical, and Bacteriological Examination.—Mitchell. Griffin & Co., London, 1900.
Veterinary Therapeutics -E Wallis Hoare. Baillière, Tindall & Cox, London, 1906. 2nd Edition.
Pictorial Practical Gardening. W. P. Wright. Cassell & Co., London, 1903. 5th Issue.
Toxines and Anti-Toxines. Oppenheimer. Griffin & Co, London, 1906.
The Africander Land.—A. R. Colquhoun. John Murray, London, 1906.
Eleanor Ormerod, LL.D., Autobiography and Correspondence R. Wallace John Murray, London, 1904.
The Book of the Rothamsted Experiments - A. D Hall. John Murray, London, 1905.
Practical Sanitation. G. Reid. Griffin & Co., London, 1906.
Entomology with reference to its Biological and Economic Aspects. J. W. Folsom. Rebman, Ltd., London, 1906.
Immunity in Infective Diseases.—E. Metchnikoff. University Press, Cambridge, 1905.
Diseases of Cattle, Sheep, Goats and Swine. Moussu & Dollar. Gay & Bird, London, 1905.
Sewage Disposal Works.—Crimp. Griffin & Co., London, 1894. 2nd Edition.
Poisons: their Effects and Detection.—A W. Blyth. Griffin & Co., London, 1906.
The Microtomist's Vade-Mecum.—A. B. Lee. J. & A. Churchill, London, 1905.
Textbook of Tropical Agriculture.—Nicholls. Macmillan & Co, London, 1906.
Cotton.—Burkett and Poe. Constable & Co., London, 1906.
Races of Domestic Poultry.—E. Brown. E. Arnold, London, 1906.
Horses for the Army.—Sir W. Gilbey. Vinton & Co., London, 1906.

British East Africa.—Lord Hindlip. T. Fisher Unwin, London, 1905.
The Romanes Lecture, 1902, "The Relations of the Advanced and Backward Races of Mankind."—J. Bryce. Clarendon Press, Oxford, 1903.
Sugar and the Sugar Cane.—N. Deerr. Norman Rodger, Manchester, 1905.
The Fern Paradise.—F. G. Heath, The Country Press, London, 1905.
Analysis of Resins, Balsams and Gum Resins.—K. Dieterich. Scott, Greenwood & Co., London, 1901.
Haeckel: his Life and Work.—W. Bölsche. T. Fisher Unwin, London, 1906.
The Handy Book on Pruning, Grafting and Budding.—Udale. Simpkin, Marshall & Co., London, 1906.
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Botany.—Sir J. D. Hooker. Macmillan & Co., London, 1904.
The Horticultural Notebook.—J. C. Newsham. Crosby, Lockwood & Son, London, 1906.
The Locust Plague and its Suppression.—Munro. John Murray, London, 1900.
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Small Destructors for Institutional and Trade Waste.—W. F. Goodrich. Constable & Co., London, 1904.
Chemistry of Dye Stuffs.—Georgievics. Scott, Greenwood & Co., London, 1903.
The Breeding Industry. W. Heape. University Press, Cambridge, 1906.
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Breeding Racehorses by the Figure System. C. B. Lowe. Horace Cox, London, 1895.
East Africa and Uganda.—J. C. Wason. Francis Griffiths, London, 1905.
The Uses of British Plants. Henslow. Lovell, Reeve & Co., London, 1905.
The Chemistry of Essential Oils and Artificial Perfumes. Parry. Scott, Greenwood & Co., London, 1899.
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Code of Rules for Judging and Suggestions to Judges, etc.—Royal Horticultural Society. Spottiswoode & Co., London, 1905. 3rd Edition.
Insects, Vols. I. and II. Westwood. Longman, Green & Co., London. Vol. I., 1839. Vol. II., 1840.
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A Manual of Public Health.—Blythe. Macmillan & Co., London, 1890.
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Wattles and Wattle Barks.—Maiden. Government Printer, Sydney, 1906. 3rd Edition.

UNITED STATES OF AMERICA.

Modern Silage Methods.—The Silver Manufacturing Co. Salem, Ohio, 1903.
Desert Botanical Laboratory of the Carnegie Institution.—Coville and MacDougal. Carnegie Institution, Washington, 1903.
Ginseng. M. G. Kains. Orange Judd Co., New York, 1899.
Agricultural Economics.—H. C. Taylor. The MacMillan Co., New York, 1905.
Dairy Chemistry.—H. Snyder. The MacMillan Co., New York, 1906.
Rocks, Rockweathering and Soils.—G. P. Merrill. The MacMillan Co., New York, 1904.
Soils.—E. W. Hilgard. The MacMillan Co., New York, 1906.
Collected Studies on Immunity.—P. Ehrlich. Wiley & Sons, New York. 1st Edition.
The Hop.—H. Myrick. Orange Judd Co., New York, 1904.
Colonial Administration.—P. S. Reinsch. The MacMillan Co., New York, 1905.

The Relation of Desert Plants to Soil Moisture and to Evaporation.—B. E Livingstone, Carnegie Institution, Washington, 1906.
Sweet Potato Culture, with a chapter on the Chinese Yam.—J. Fitz. Orange Judd Co., New York, 1906.
Clovers and How to Grow Them.—T. Shaw. Orange Judd Co., New York, 1906.
Text Book of Volumetric Analysis.—Schimpf. Wiley & Sons, New York, 1906. 4th Edition
Soils and Crops of the Farm.—Morrow and Hunt. Orange Judd Co., New York, 1905.
Fungi and Fungicides.—C. M. Weed. Orange Judd Co., New York, 1896.
How to Choose a Farm.—Hunt. The MacMillan Co., New York, 1906.
From the Cotton Field to the Cotton Mill—H. Tompson. The MacMillan Co., New York, 1906.
Hemp.—S. S. Boyce. Orange Judd Co, New York, 1900.
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FRANCE.

Trypanosomes et Trypanosomiases.—Laveran et Mesnil Nassau et Cie., Paris, 1904.
Sericulture.—P. Vieil. Baillière et Fils, Paris, 1905.

GERMANY.

Beiträge zur Gerichtlichen Chemie einzelner organischer Gifte.—Dragendorff. H. Schmitzdorff St. Petersburg, 1872

S. W. WAGSTAFF,
Librarian

GENERAL NOTICES.

LIST OF FARMERS' ASSOCIATIONS AND AGRICULTURAL SOCIETIES IN THE TRANSVAAL.

Aapjes River Ward Agricultural Society, A. F. von Gass, Pyramid Station.
Aapjes River Ward Farmers' Association, F. Carlisle, Pyramid Station.
Barberton Farmers' Association, Geo. E. O. Wilhelm, Box 157, Barberton.
Barberton Agricultural Society, J. S. Dyce, Box 5, Barberton.
Barberton and District Farmers' Association, G. E. O. Wilhelm, Secretary and Treasurer, Box 157, Barberton.
Bloemhof Agricultural Society, W. L. Dagg, Bloemhof.
Carolina Agricultural Society, M. van Enter, Box 43, Carolina.
Christiana Agricultural Society, Secretary, Christiana.
Crocodile River Farmers' Association, F. J. van Deventer, Box 751, Pretoria.
Eastern Transvaal Farmers' Association, T. W. Snaith, Box 75, Springs.
Ermelo Agricultural Society, A. Smuts, Box 5, Ermelo.
Elands River Farmers' Association, E. H. Eloff, Rietvlei, Lindley's Poort, Rustenburg.
Haenertsburg Farmers' Association, Haenertsburg, *via* Pietersburg.
Heidelberg Agricultural Society, W. Harvey, Box 36, Heidelberg.
Hekpoort Farmers' Association, Secretary, *via* Krugersdorp.
Hex River Farmers' Association, W. Breedt, Hex River, Rustenburg.
Highveld Farmers' Association, F. Findley, Ceylon, *via* Krugersdorp.
Highveld Farmers' Association, W. Robinson, Rustenburg.
Klerksdorp Agricultural Society, H. Bramley, Box 56, Klerksdorp.
Klip River Farmers' Association, Krugersdorp.
Koesterfontein Farmers' Association, Secretary, *via* Krugersdorp.
Krugersdorp Farmers' Association, G. Figulus, Box 188, Krugersdorp.
Krugersdorp Agricultural Society, H. A. von Blommestein, Box 368, Krugersdorp.
Lydenburg Agricultural Society, S. Hiemstra, Box 69, Lydenburg.
Lydenburg Farmers' Association, E. de Souza, Lydenburg.
Leuwdoorns Farmers' Association, W. Sterling Hamilton, Syfergat, Leuwdoorns, *via* Klerksdorp.
Marico Agricultural Society, J. L. van Heerden, Box 82, Zeerust.
Middelburg Agricultural Society, J. W. Henwood, Box 229, Middelburg.
New Scotland Farmers' Association, H. S. Parry, Grasdal, Lake Chrissie.
New Agatha Farmers' Association, R. F. Shirley, New Agatha, *via* Pietersburg.
Pietersburg Agricultural Society, J. W. Johnson, Box 32, Pietersburg.
Pietersburg Farmers' Association, G. G. Munnik, Pietersburg.
Pietersburg Poultry Club, H. Moore, Box 103, Pietersburg.
Piet Retief Farmers' Association, K. P. van Dijk, Box 18, Piet Retief.
Pisanghoek Farmers' Association, W. J. Brickhill, Diana, *via* Pietersburg.
Platrand Farmers' Association, A. H. Barron, Platrand.
Potchefstroom Agricultural Society, Secretary, Box 70, Potchefstroom.
Potgietersrust Fruitgrowers' and Planters' Association, H. J. Ströbel.
Pretoria Agricultural Society, H. Cornforth, Box 685, Pretoria.
Rand Poultry Club, F. H. Stoll, Box 2712, Johannesburg.
Rustenburg Farmers' Association, Leo Machol, Rustenburg.
Settlers' Association, Hon. H. Wyndham, Kroomdraai.
Southern Waterberg Farmers' Association, C. M. Quarry, P.O. Warmbaths.
Standerton Agricultural Society, F. C. de Witt, Box 158, Standerton.
Transvaal Agricultural Union, F. T. Nicholson, Box 134, Pretoria.
Transvaal Farmers' Association, E. W. Hunt, Box 3785, Johannesburg.
Transvaal Land Owners' Association, H. A. Baily, Box 1281, Johannesburg.
Transvaal Poultry Club, J. F. Hilson, Box 1129, Pretoria.
Transvaal Stockbreeders' Association, F. T. Nicholson, Box 134, Pretoria.
Transvaal Tobacco Growers' Association, Capt. Madge, Secretary, Box 4303, Johannesburg.
Vaal River Farmers' Association, J. van Zijl, *via* Potchefstroom.
Waterberg Agricultural Society, I. von Backstroom, Box 7, Nylstroom.
Wakkerstroom Agricultural Society, G. Maasdorp, Volksrust.
Witfontein Farmers' Association, J. Krugel, *via* Krugersdorp.
Witwatersrand Farmers' Association, H. J. A. Wentworth, P.O. Craighall, near Johannesburg.
Witwatersrand Dairy Farmers' Association, H. Clarke, Box 5908, Johannesburg.

Witwatersrand Agricultural Society, W. H. Poultney, Box 4344, Johannesburg.
White River Farmers' Association, Archibald T. Ralls, White River, *via* Nelspruit.
Wolmaransstad Farmers' Association, F. W. Konig, Box 1, Wolmaransstad.
Wonderfontein Farmers' Association, Secretary, *via* Krugersdorp.
Woodbush Farmers' Association, Secretary and Treasurer, Percy Kent, Spitskop, P.O. Haenertsburg.
Zwartkop Farmers' Association, M. Vorster, Zwartkop, *via* Krugersdorp.
Zwartruggens Farmers' and Planters' Association, G. R. Wedderburn, J.P., Broadwood Vale, P.O. Kosterfontein, Rustenburg.

OTHER COLONIES.

Agricultural Union of Cape Colony, D. M. Brown, Box 187, Port Elizabeth.
Bloemfontein and O.R.C. Agricultural Society, J. Fraser, Box 250, Bloemfontein.
Cape Central Farmers' Association, H. C. Hall, Bedford, Cape Colony.
Cape Stud Breeders' Association, J. Pike, Box 703. Capetown.
Natal Agricultural Union, D. M. Eadie, Timber Street, Pietermaritzburg.
Orange River Colony Central Farmers' Association. W. B. Fowler, Secretary, Hill's Buildings, Maitland Street, Bloemfontein.
Orange River Colony Stockbreeders' Association, Secretary, Bloemfontein.
Rhodesian Agricultural Union, Secretary, Box 135, Salisbury, Rhodesia.
South African Co-operative Union, A. C. Lyell, Box 574, Bloemfontein, O.R.C.
Upper Klip River Farmers' Association, Secretary, Vrede District, O.R.C.

* * * *

PORTS FOR ENTRY OF STOCK.

The following are the ports for entry of stock into this Colony from the neighbouring territories:—

Mafeking Road Border	Cape Colony.
Mosimyani	"
Fourteen Streams	"
Coal Mine Drift	Orange River Colony.
Vereeniging	"
Roberts' Drift	"
Volksrust	Natal
Komati Poort, through which stock not provided for under Clause 5, Government Notice No. 834 of 1903, will only be allowed to proceed by rail, to be examined at Machadodorp	Portuguese East Africa.

* * * *

DISEASES OF STOCK.

(Government Notice No. 834 of 1903.)

1. In these Regulations the term "Stock" means cattle, sheep, goats, horses, mules, donkeys, and pigs.

2. The following diseases shall be considered contagious diseases for the purpose of these Regulations, and shall be dealt with as hereinafter directed. The list may be added to by Proclamation in the *Gazette*:—

(*a*) Rinderpest.
(*b*) Pleuro-pneumonia (or lung-sickness).
(*c*) Redwater and Rhodesian Redwater.
(*d*) Tuberculosis.
(*e*) Foot and Mouth Disease.
(*f*) Anthrax (or splenic fever).
(*g*) Glanders and Farcy.
(*h*) Scab in Sheep and Goats.
(*i*) Swine Fever.
(*j*) Swine Erysipelas.
(*k*) Mange (Scabies) in Horses and Mules.
(*l*) Ulcerative Lymphangitis.
(*m*) Sheep Pox.

* * * *

AFRICAN COAST FEVER.

Amended Proclamation of the Cape Colony.

By Proclamation No. 231 of July 22nd, 1904, the provisions of Proclamation No. 202 of June 29th, 1904, are amended as follows:—

Dogs and cats will be admitted with special permission of the Chief Veterinary Surgeon, or his authorised representative, provided they are accompanied by a certificate signed by the Principal Veterinary Surgeon of the Transvaal, or his authorised representative, to the effect that they have not come from or passed through any portion of the Transvaal proclaimed or known to be infected with African Coast Fever.

* * * *

SWINE FEVER.—WITWATERSRAND.

The outbreak of Swine Fever in the Witwatersrand District having been stamped out, the Government Notice declaring the said area infected has been cancelled. It is, therefore, no longer necessary to obtain permits to move pigs into or out of the Witwatersrand District.

* * * *

GOVERNMENT NOTICE No. 404 OF 1907.

It is hereby notified for public information that compensation will be paid for visibly healthy equines, which, when the Mallein test is applied to them by an authorised Officer of the Agricultural Department, re-act to such test, and are afterwards destroyed by order of the Principal Veterinary Surgeon in consequence of their having so re-acted.

Provided that :—

(*a*) Such re-acting equines were tested and found to re-act for the first time subsequent to 24th January, 1907, and have been destroyed by order of the Principal Veterinary Surgeon since that date.

(*b*) Such re-acting animals are not found amongst newly imported equines when these animals are tested by an authorised Officer of the Agricultural Department at a Proclaimed Port of Entry, or at the border of the Colony or on arrival at their destination.

(*c*) No compensation will be paid on a greater scale than two-thirds of the value of the animal destroyed, and in no case will a greater sum than £20 be paid for any animal destroyed as aforesaid. The value of any animal destroyed will be determined by the Principal Veterinary Surgeon, or his authorised representative.

(*d*) Compensation will not be paid for any animals showing any clinical indication of glanders which are ordered to be destroyed by the Principal Veterinary Surgeon. or by any person acting on his instructions.

Government Notice No. 103 of 1907 is hereby withdrawn.

J. C. SMUTS,
Acting Minister of Agriculture.

Office of the Minister of Agriculture,
Pretoria, 5th April, 1907.

* * * *

GOVERNMENT NOTICE No. 435 OF 1907.

It is hereby notified for general information that, on account of the prevalence of Lung-sickness in the Cape Colony, permits for the admission of cattle from Cape Colony into the Transvaal will only be issued upon application to the Director of Agriculture, Pretoria, and provided such application is accompanied by a certificate, signed by a Government Veterinary Surgeon, Cape Colony, setting forth that the cattle in respect of which such application for permit is made, are healthy, and that there has been no case of Contagious disease for at least three months previous to the date of such certificate upon the property on which such cattle have been.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture,
Pretoria, 13th April, 1907.

* * * *

GLANDERS AND FARCY.

WARNING TO THE PUBLIC.

A considerable number of outbreaks of Glanders having been reported to the Agricultural Department as having occurred in various districts of the Colony during the past few weeks, the public are warned against the purchase of equines from unknown travelling dealers or on auction sales, unless the animals put up for sale are sold with a written guarantee signed by the owner, certifying that they are free from any contagious disease, as there is no doubt that unscrupulous persons have lately been disposing of infected animals at prices which have tempted the public to purchase the same, and that the disease has subsequently appeared in the stables of purchasers to their loss and detriment.

It is further recommended that all newly purchased equines should be kept isolated and should be watered separately and apart from any other equines on the premises for a period of three weeks after purchase, and should they show any indications suspicious of Glanders, a report should be forwarded at once to the Government Veterinary Surgeon of the District.

The following description of the disease is appended for the information of the public, and special attention is called to Government Notice No. 103 of 1907, which appears underneath.

Glanders and Farcy.

These two names are applied to one and the same disease, which is due to a microbe—Bacillus Malleus. The disease is called Farcy when located on the limbs or body: Glanders when the principal symptoms are seen in the nostrils, submaxillary glands, and lungs.

The horse tribe is most commonly affected with Glanders. Man not infrequently gets the disease from the horse by inoculation through a wound. The dog, the cat, and wild carnivora may be infected. The ox is absolutely immune. Sheep, goats, and pigs are immune for all practical purposes.

A horse may be affected with Glanders and show no symptoms except slight unthriftiness. This is called occult Glanders, and can only be diagnosed by the mallein test.

In typical clinical cases there is a thick grey-coloured discharge from one or both nostrils. Ulcers and ulcerous patches are seen inside the nasal cavities and the glands under the jaw are enlarged and hard. The temperature may be raised, but in chronic cases it may be no higher than the normal. In severe and acute cases the temperature is several degrees above normal and the animal shows distinct symptoms of respiratory disease. In Farcy one or more limbs become swollen. The lymph vessels stand out prominently on the inside of the limbs. The vessels give a cord-like feel to the hand, and small nodules appear along the course of the vessels. These nodules become ulcers which discharge a thick yellow fluid of oily appearance. The ulcers may heal and leave a scar, but they usually break out again. Farcy may also appear on the skin of the neck and body.

One sees the ulcers on the skin if Farcy has been present. Besides what one sees in the live animals, one may also find ulceration of the throat and air passages. The most constant changes are found in the lungs. In acute Glanders, small grey nodules about the size of a pin-head are seen all through the lung substance. In the chronic forms the nodules in the earlier stages appear as small grey patches with a red margin. Others are of pus-like consistence. The older nodules are hard and shot-like to the touch; some of them are gritty—calcification. The number of nodules in a lung varies from one or two to hundreds. The donkey suffers from an acute form of Glanders in which the lungs are inflamed over a large surface. The tissue is solid, and on section the surface of the lung has a greyish red colour.

* * * *

GOVERNMENT NOTICE No. 31 OF 1907.

Under and by virtue of the powers in him vested by section *four* of the Diseases of Stock Ordinance, 1902, His Excellency the Acting Lieutenant-Governor has been pleased to prohibit, until further notice, the importation of Cattle from the Colony of Natal into this Colony, with the exception of stock entering under permit from oversea and passing through Natal by rail direct; provided that notwithstanding such prohibition, slaughter cattle for which permits have at the date of this notice been issued under Regulation 8 of the Regulations published under Government Notice 1288 of 1906, shall be admitted subject to the terms of such regulations.

Government Notice No. 1287 of 1906 shall be and is hereby withdrawn.

By command of His Excellency the Acting Lieutenant-Governor.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 9th January, 1907.

* * * *

GOVERNMENT NOTICE No. 32 OF 1907.

His Excellency the Acting Lieutenant-Governor has been pleased to repeal the regulations published under Government Notice 1288 of 1906, and to substitute the following therefor:—

1. Any person who shall import any cattle from the Colony of Natal into this Colony, save cattle entering under permit from oversea and passing through Natal by rail direct, shall be liable, on conviction, to a fine not exceeding £50, and, in default of payment, to imprisonment, with or without hard labour, for a period not exceeding six months.

2. Any cattle which may, after the date of the promulgation of these regulations, have come into this Colony from the Colony of Natal, save as is excepted in the preceding regulation, and save such slaughter cattle for which permits have at the date of this notice been issued, may be seized by any Resident Magistrate, Native Commissioner, Sub-Commissioner, Justice of the Peace, Police Officer, or Constable, and detained and taken to a place of isolation, and the person so seizing and detaining such cattle shall immediately report all the circumstances to the Commissioner of Lands, who may order any such cattle to be slaughtered or otherwise dealt with.

By Command of His Excellency the Acting Lieutenant-Governor.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 9th January, 1907.

* * * *

MADAGASCAR CATTLE.

His Majesty's Consul at Antananarivo has notified His Excellency the High Commissioner that the Export Duty on bullocks from Madagascar has been reduced from twelve shillings to two shillings per head.

* * * *

AN ORDINANCE (No. 3 OF 1906) TO IMPOSE A DUTY ON THE EXPORT OF ANGORA RAMS AND EWES.

Be it enacted by the Lieutenant-Governor of the Transvaal with the advice and consent of the Legislative Council thereof as follows:—

1. Upon every Angora ram or ewe exported from this Colony after the date of the taking effect of this Ordinance there shall be payable save as herein provided to the officer appointed to receive the same a duty of one hundred pounds; provided always that no such duty shall be payable on the export of any such ram or ewe to any Colony or Territory in South Africa as soon as the Lieutenant-Governor shall by proclamation declare that such Colony or Territory has by statute provided for the imposition of a duty on the export of Angora rams and ewes not less than the amount imposed by this Ordinance.

2. Every person who shall export from this Colony any Angora ram or ewe (save as in this Ordinance provided) without payment of the duty imposed thereby shall be liable on conviction in addition to the duty to a fine of not less than twenty-five pounds and not exceeding one hundred pounds for every such ram or ewe so exported and in default of payment to imprisonment with or without hard labour for a period of not less than one month and not exceeding six months unless such fine be sooner paid.

3. Courts of Resident Magistrates shall have special jurisdiction to impose any of the penalties provided by this Ordinance for a contravention hereof.

4. It shall be lawful for the Lieutenant-Governor from time to time to make regulations for carrying out the provisions of this Ordinance.

5. This Ordinance may be cited for all purposes as the Angora Export Duty Ordinance 1906.

Passed in Council the twenty-eighth day of June, One thousand Nine hundred and Six.

* * * *

DESTRUCTION OF VERMIN.

The following regulation (Section D of Government Notice No. 1341 of 1906) is published for general information:—

(D.)—VERMIN.

16. The animals named in Schedule F hereto shall be deemed to be vermin, and rewards for the destruction of them shall be paid at the rates shown in the Schedule by the Resident Magistrate of the district in which they are destroyed.

17. Vermin may be destroyed by shooting, coursing, by means of nets, springes, gins, traps, snares, or by poison, provided that when poison is used for the destruction its use shall be subject to such conditions as the Resident Magistrate of the district may prescribe, and provided that no poison may be used during the open season.

18. In proof of the destruction of vermin the applicant for reward will be required to produce in the case of lion, leopard, cheetah, lynx, serval cat, civet cat, Kaffir cat, genet cat, silver jackal and red jackal, the skin with the tail not severed; and in the case of wild dog, hyena and baboon, the head; and will also be required to make a written declaration in the form given in Schedule G hereto.

19. The skins of vermin for the destruction of which reward has been paid shall be the property of the Government, and shall, if in good condition be marked by the official before whom they are produced at the juncture of the tail with the skin of the body with a perforating stamp, or in such other way as the Colonial Secretary may from time to time prescribe, and thereafter be sold by the Resident Magistrate by public auction or disposed of in such other way as he may consider to be best in the interests of the Government. The proceeds of such sale or disposal shall be paid into Revenue.

Skins not in good condition and heads shall be destroyed.

20. Any person who secures or attempts to secure for himself or any other person a reward for the destruction of vermin by means of a false declaration or by the production of skins or heads belonging to vermin, for the destruction of which a reward has already been paid, shall be liable on conviction to a fine not exceeding £10 for every head of vermin for which he has secured or attempted to secure such reward.

SCHEDULE F.

	£	s.	d.
Wild Dog	1	0	0
Silver Jackal	0	2	6
Red Jackal	0	5	0
Baboon	0	2	6

SCHEDULE G.

I, ...
hereby declare that the following animals:—
....
....
....
....
....
have been destroyed by me within the official boundaries of the ....
District, and that the skins and tails (or heads) I have produced to the Resident Magistrate actually belonged to such animals.

* * * *

IRRIGATION AND WATER SUPPLY DEPARTMENT.

REGULATIONS AND CONDITIONS FOR THE HIRE OF A GOVERNMENT WATER DRILL FOR BORING FOR WATER.

1. Submission of Applications.

Applications by farmers for the hire of a Government Water Drill for boring for water should be sent on form $\frac{\text{I. D.}}{\text{B.}}$ No. 49 (Revised), to the Boring Engineer, Irrigation Department, P.O. Box 557, Pretoria, through the Resident Magistrate of the district in which the applicant resides.

2.—Acceptance of Applications.

This is subject to such enquiry by the Resident Magistrate and Boring Engineer as may be deemed necessary for ascertaining the following particulars:—

(*a*) Geographical and geological practicability of the proposed bore.
(*b*) Ability of applicant to pay all charges.
(*c*) Necessity for water (1) for domestic purposes, (2) for stock, (3) for irrigation.
(*d*) Proximity to other proposed bores.

Special regard will be given to the development of Farming and Agricultural Industries.

3.—Notification of Acceptance of Application.

The acceptance of his application will be notified to the applicant by the Boring Engineer, through the Resident Magistrate. The applicant may be requested to give further necessary information before boring is commenced for him.

4.—Notice of Availability of Drill.

Each accepted applicant will have at least eight days' notice that a drill has been set apart for him. This notice will state where the drill is and the date from which the applicant

should take it over. Should he not take it over within three days of the fixed date, he will be liable to forfeit the grant of the drill to him and to pay for the foreman's wages during the delay. The taking over of the drill shall preclude the applicant from any denial of liability for it.

5.—Classes of Government Drills.

Government will provide one or other of the following classes of drill, at the discretion of the Boring Engineer, unless some prior arrangement has been made with the applicant :—

(*a*) Steam diamond drill capable of boring to 1,000 feet a 3 inch hole, which can be enlarged to 4 inches to a depth of 200 feet.

(*b*) Steam diamond drill capable of boring to 500 feet a 3 inch hole, which can be enlarged to 4 inches to a depth of 100 feet.

(*c*) Steam percussion (or "jumper") drill capable of boring a 6 inch hole to a depth of 300 feet.

(*d*) Steam diamond drill (deep or artesian) capable of boring a 3 inch hole to a depth of 5,000 feet.

The above drills are all equipped with the necessary tools and appliances and a tent or house for the foreman. For (*d*) the equipment will be arranged for specially as required.

6.—The Foreman.

The foreman will be a capable man and will have the entire direct charge of the boring operations. He will receive instructions to meet the applicant's wishes as far as practicable, to use all expedition in carrying out the bore for him, and not to give him unnecessary trouble. Should the applicant have any complaint to make about him, he should prefer it in writing to the Resident Magistrate, who will inquire into the matter. No payment for his services is to be made to the foreman by the applicant.

7.—Charges.

The charges to be paid by the applicant will be :—

(*a*) From the date of the arrival of the drill on the farm to be bored on, the sum of £1 for every day for the foreman's wages, until such time as the plant has been off-loaded and erected. A similar daily charge of £1 will also be made during pumping tests.

(*b*) For each working day from the erection of the drill, the sum of £2 (Saturday to be reckoned half a day).

(*c*) In the case of the last applicant in a district, the sum of £1 for every day until the drill shall have been delivered at the nearest railway station or centre.

(*d*) For Artesian Diamond Drills, class (*d*), the charge will be by special arrangement.

(*e*) Any breakages for which the applicant is himself responsible.

The cost of replacements or repairs necessitated by boring, pure and simple, will be borne by Government.

(*f*) No charge will be made for periods during which a drill may be stopped for repairs or on account of bad weather or of the illness of the foreman, but full charges must be paid for any delay caused by the applicant.

8.—Transport.

(*a*) Government will bear the cost of carriage by rail of the drill, appliances, and foreman in charge thereof, to the railway station or centre nearest to the farm of the first applicant in any district.

(*b*) Government cannot guarantee transport, but where there is a Government transport station available and the applicant cannot himself arrange for the transport of the drill, will provide it for him at the Government rates. Drills cannot, however, be sent out to districts where there is animal sickness or where there are restrictions against the movement of animals.

(*c*) The first applicant will provide transport for the drill and its appliances and for the foreman and his baggage from the station or centre to his farm, and will use all expedition in this respect.

(*d*) A succeeding applicant will similarly provide transport from the previous farm to his own farm, and the last applicant will provide it back to the nearest railway station or centre, if required to do so.

(*e*) The applicant will also provide transport from time to time as required between his farm and the railway station, or such other spot as may be selected, for the purpose of repairs to machinery, etc.

(*f*) The applicant will also provide means of communication to and from the nearest post and telegraph office at least once a week.

9.—Casing.

When the hole or part of a borehole is not in solid rock, the hole must be lined with casing, which, if desired, will be supplied by Government to the applicant at the net cost rates, but not exceeding the following:—

For up to 4 inch hole	4s. per foot.
For 4 inch up to 6 inch hole	5s. per foot.

The applicant will not be charged for undamaged casing removed from a hole nor for the first 20 feet of casing.

10.—Working Hours.

Working hours on ordinary week-days will be nine per day, except on Saturdays, when they will be five hours, and work will cease at 1 p.m.

No work will be done on Sundays and public holidays, nor will a charge be made for these days.

11.—Supplies by Applicant.

(*a*) *Labourers.* Government will provide, free of charge, the natives required for working the drilling machine. The applicant must supply, free of all charges, such other natives as may be required for unloading and loading-up the plant.

(*b*) *Water and Fuel.* The applicant must supply, and transport at his own cost, sufficient fuel (wood or coal) and water for the proper working of the drill, and for the use of the foreman and natives.

(*c*) *Provisions for Foreman.* The applicant must either supply food for the foreman by private arrangement and at reasonable prices, or must bring supplies for him from a store not less than once a month.

(*d*) The applicant must generally give such other assistance as the foreman may require to perform his work efficiently.

12.—Cessation of Boring.

Boring will be stopped:—

(*a*) At the applicant's request in writing to the Boring Engineer;

(*b*) When a fair and reasonable supply of water has been struck;

(*c*) At the discretion of the Boring Engineer when there is, or is likely to be, any damage to the drill, or further boring is unlikely to yield satisfactory results;

(*d*) When the borehole is 300 feet deep, unless a special arrangement is made by the applicant with the Boring Engineer to continue it.

13.—Responsibility for Success.

Beyond providing an efficient plant and foreman, Government do not guarantee any successful result from the boring operations. The undertaking will, therefore, be entirely at the applicant's risk, but every reasonable assistance towards a successful issue of the work will be readily given.

14.—Limit of Period of Work and Number of Boreholes.

A drill will not work on account of any one applicant for a longer period than 48 working days, unless exceptional circumstances justify an extension of this period.

Not more than three boreholes will be sunk on any one property, under one application, except under special sanction. Holes abandoned by order of the Boring Engineer will not be taken into account in this respect.

15.—Special Conditions.

Further special conditions, additional to the foregoing, when necessitated by the nature of the ground to be bored in or by difficulty in getting to the site, may be imposed by the Boring Engineer after consultation with the applicant. Their acceptance by the applicant must be definitely notified before any work is undertaken or continued.

16.—Cores.

As the Boring Branch is desirous for scientific purposes of collecting cores, showing the strata of the Colony, all cores saved shall be its absolute property. The applicant, however, may closely examine them, and may, if he desires and at the discretion of the Boring Engineer, have small pieces given to him for analytical purposes. Samples of all cores thus acquired by the Government will be carefully kept and registered.

W. L. STRANGE,

Director of Irrigation and Water Supply.

SPECIFICATION OF HORSES REQUIRED FOR PURCHASE BY THE MILITARY AUTHORITIES.

Horses of three classes are required, viz. :—

Draught ; Cavalry ; and Mounted Infantry.

Draught ...	...	...	15 hands to 15-2.
Cavalry ...	...	...	14-2½ to 15-2.
Mounted Infantry	...	...	14 to 14-2½.

The class of animal required in each of the three classes may be generally described as short-legged, compact-bodied, practically sound, with good constitution and bone to match his size, not under four years or over seven years.

The matter of the horses being broken or unbroken is immaterial, but any horse brought forward for sale must be so far handled that the veterinary examinations as to soundness in walk, trot or gallop can be carried out without delay in the presence of the purchasing officer.

A purchasing officer would be the sole judge of the suitability or otherwise of the animal produced for sale, and he would not buy any animal having any of the following defects :—

(*a*) Small weak quarters ; (*b*) Flat sides ; (*c*) Long weak or very straight pasterns ; (*d*) Split up and leggy ; (*e*) Small bones or points ; (*f*) Close hocks or action ; (*g*) Narrow chest ; (*h*) signs of brushing ; (*i*) Small or uneven feet ; (*j*) Vice of any kind ; (*k*) Bad withers or signs of fistulous withers ; (*l*) Bad condition ; (*m*) Mis-shaped mouth, or mouth showing evidence of operation to teeth ; (*n*) Capped elbows or very short docks.

Mares and geldings will only be bought, and colour is immaterial.

The Military Authorities will prefer to deal direct with the breeders and would purchase at any time of the year, and if local Agricultural Associations could at their meetings ascertain what animals could be offered for sale and what centre and date would be most suitable, and notify the same to the Assistant Director of Remounts, at Headquarters, Pretoria, arrangements would then be made for a purchasing officer to attend, but it would be advisable for a month's notice to be given and the collection of horses for inspection should be, having due regard to the seller's convenience, as near the line of railway as possible.

Local Associations should first ascertain from Assistant Director of Remounts, Army Headquarters, whether horses are required.

No fixed price can at present be laid down owing to the scarcity of the class of animal required in this country, but a fair market price would be offered, having in consideration the price of horses available for importation from oversea.

The Military Authorities will not complete the purchase of any animal till it is delivered alive, without injury (which would render it permanently unserviceable), and free from infectious or contagious disease, at a railway station to be fixed by the purchasing officer.

For the care and feeding of such horses as may be selected for purchase and which for any reason it may be impossible to at once entrain, an allowance of 2s. per day will be made to the seller, such allowance not to be payable for the day of purchase but will be allowed for the day of entrainment, provided that 10 lbs. of forage suitable for use on the journey be certified by the entraining officer or conductor to have been placed at his disposal.

The seller will pay for any cost of hire of ground for inspection purposes and must put a halter or other suitable head-gear on the horse to secure it on the railway journey.

He must also allow the horse to pass the Mallein test with Mallein supplied by the Army Veterinary Department, and this test will be applied before entrainment. Should re-action take place within 72 hours the purchase will not be completed, and the feeding allowance of 2s. only would be paid from the date subsequent to selection to the date certified of re-action.

The purchasing officer on selecting a horse as suitable will at once mark a horse so selected with a burnt brand on the foot and take a description noting all marks on the animal, but such brand will not complete the sale if the safe delivery and Malleining conditions are not carried out.

The purchase money will be paid by cheque by the Assistant Director Remounts, Pretoria, immediately on receipt of notice from the purchasing officer that the purchase conditions have been completed.

E. N. BANKES, Lieut.,
Staff Officer, Remounts,
For Assistant Director of Remounts, South Africa.

* * * *

GOVERNMENT NOTICE No. 522 OF 1906.

Under and by virtue of the powers in him vested by Section 4 of the Diseases of Stock Ordinance of 1902, His Excellency the Acting Lieutenant-Governor has been pleased to prohibit, until further notice, the importation of cattle from the Colony of Natal, with the exception of

(1) Stock entering under permit from oversea and passing through Natal by rail;

(2) Slaughter stock travelling direct by rail under permit to any enclosure approved by the Government Veterinary Department for the reception of such slaughter stock.

By Command of His Excellency the Acting Lieutenant-Governor.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 25th May, 1906.

* * * *

GOVERNMENT NOTICE No. 523 OF 1906.

His Excellency the Acting Lieutenant-Governor has been pleased to make the following regulation under Section 5 of the Diseases of Stock Ordinance of 1902:—

Any person who shall import or cause to be imported any stock into this Colony in contravention of the terms of Government Notice No. 522 of 1906, or who shall remove any stock alive from any enclosure therein mentioned, shall be liable upon conviction to a penalty not exceeding Fifty Pounds, and in default of payment of the same to imprisonment with or without hard labour for a period not exceeding six months.

Any cattle introduced without such permit as is mentioned in the said Government Notice may be slaughtered by order of the Commissioner of Lands, or dealt with in whatever manner the Commissioner may prescribe.

By Command of His Excellency the Acting Lieutenant-Governor.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 25th May, 1906.

* * * *

RABIES IN RHODESIA.

The Secretary for Agriculture writes as follows:—

The disease is increasing. The last outbreak in a previously non-infected area occurred at a farm in the Enterprise District, about 25 miles from Salisbury, on 25th ultimo. Within the past six months one European and two natives have died of hydrophobia. The nearest reported case to the Transvaal border during the past twelve months occurred near the township of Gwanda.

Steps are now being taken to have all dogs in the country registered, and it is hoped by this means to reduce the number of native owned dogs, which are regarded as the chief cause of the spread of the disease, and to trace the source of any outbreak, so that the number of dogs in the district of origin may, if necessary, be destroyed.

* * * *

TRANSVAAL INDIGENCY COMMISSION.

1. To enquire and report whether conditions of indigency exist among persons of European nationality in the Transvaal such as to require remedial measures.

2. To consider the origin and effect of such conditions,
   (*a*) as affecting persons born in South Africa;
   (*b*) as affecting persons who have immigrated from other countries.

3. To enquire and report as to the cause of such conditions and, in particular, how far they arise from any or all of the following causes—
   (*a*) general economic conditions, whether temporary or permanent;
   (*b*) the operation of particular laws or customs, especially those relating to the tenure and transmission of landed property;
   (*c*) deficiencies in training or education.

4. To enquire and report what measures should be taken, if any, for the abatement of the evil, and more particularly to advise how far those measures should be taken by the Government, how far by Local Authorities, and how far by private agencies; and to what extent, in the last two cases, Local Authorities or private agencies should be subsidised and controlled by the Government.

5. To enquire into the control of public orphanages, and to advise whether they should be managed and paid for by the Government, and, if not, whether they should be managed and paid for by Local Authorities or private societies, and, if so, how far it is desirable that such Local Authorities or private societies should be subsidised by the Government.

The members are:—

John William Quinn (*Chairman*), General Louis Botha, Hugh Crawford, Richard Feetham, Johan Rissik, Frank Braybrooke Smith (*Director of Agriculture*).

Mr. Philip Henry Kerr, Assistant Secretary to the Inter-Colonial Council, has been appointed Secretary to the Commission.

* * * *

GOVERNMENT NOTICE No. 1138 OF 1906.

REGULATIONS UNDER THE GREAT STOCK BRANDS ORDINANCE, 1904.

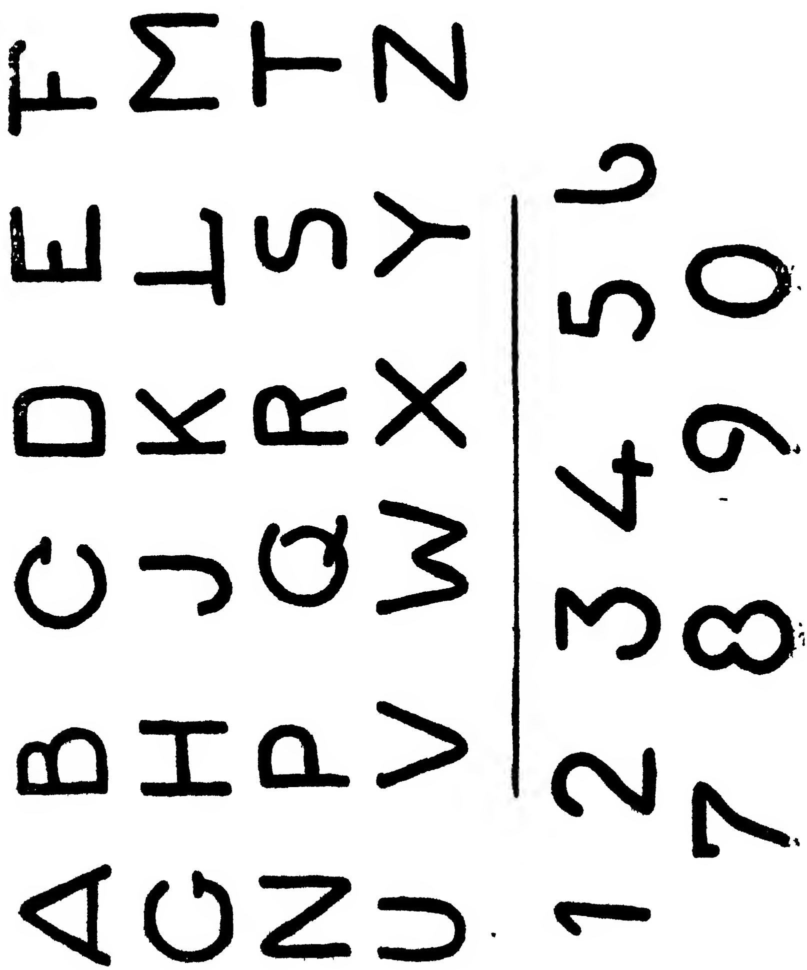
It is hereby notified for general information that His Excellency the Acting Lieutenant-Governor has been pleased to approve of the following Regulations under the powers vested in him by the Great Stock Brands Ordinance, 1904.

ADAM JAMESON,
Commissioner of Lands.

Office of the Commissioner of Lands,
Pretoria, 29th October, 1906.

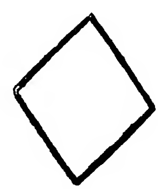
I.—Every brand allotted and registered in pursuance of the provisions of Section *five* of the Great Stock Brands Ordinance, 1904, shall consist of two plain Roman letters and one numeral of an Arabic pattern, and shall be of such shape and pattern as specified in Diagram I. hereunder :—

Diagram I.—Shape and Pattern of Characters.



II.—The first character of every Pound Brand allotted and registered in accordance with the provisions of Section *twenty-six* of the Great Stock Brands Ordinance, 1904, shall be a diamond of the shape and form as illustrated in Diagram II. hereunder :—

Diagram II.—Shape and Pattern of Diamond.

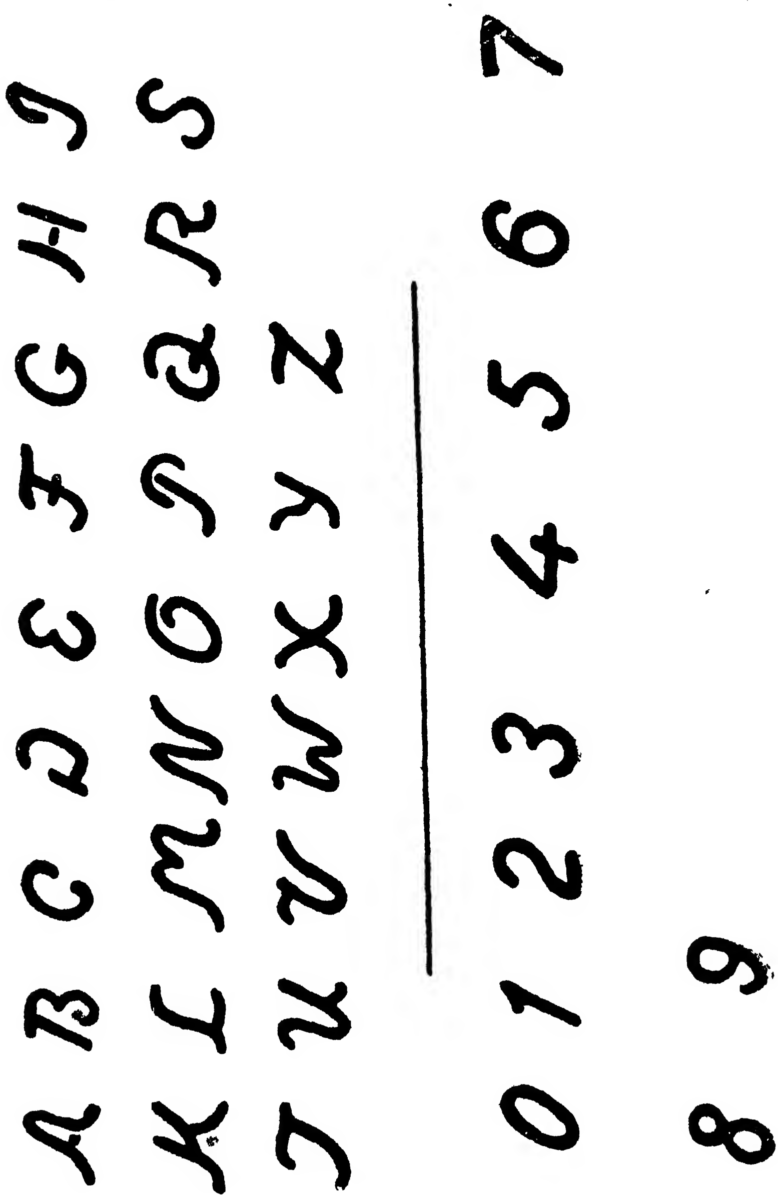


The remaining characters of every Pound Brand shall be of the same shape and pattern as illustrated in Diagram I.

III.—One character of every Native Location brand allotted and registered under Section *sixteen* of the Great Stock Brands Ordinance, 1904, shall be a dagger as illustrated in Diagram III., hereto appended, and of the remaining characters the one shall be a letter and the other a numeral, and both such letter and numeral shall be of an italic pattern as illustrated in Diagram IV.

Diagram III.—Shape of Dagger.

Diagram IV.—Shape and Pattern of Italic Letters and Numerals.



IV.—The shape and pattern of branding irons and other marking instruments shall be subject to the approval of the Director of Agriculture.

V.—Whenever an impression of a branding iron is required, the Registrar of Brands shall forward to the owner thereof a form as prescribed in Schedule A hereto, which shall be filled up as directed thereon, and returned by the owner within fourteen days. If it appears from the impression that such brand has not been made in conformity with the prescribed regulations, such owner, on being required so to do by the Registrar, shall immediately make or cause the necessary alterations to be made.

VI.—Every butcher shall keep a book, in the form of Schedule B hereto, open at all times to inspection by any inspector of Brands, Police Officer or other person duly authorised in that behalf, and shall enter therein the Brands cut or imprinted on every animal slaughtered or otherwise dealt with.

VII.—Every Auctioneer shall keep a book, in the form of Schedule C hereto, and shall truly enter therein all stock sold or dealt in by him in the ordinary course of business. Such book shall be open at all times to inspection by any Inspector of Brands, Police Officer, or other person duly authorised on that behalf.

VIII.—Any person failing to comply with or offending against any of the provisions of these regulations shall, on conviction, be liable to a fine not exceeding twenty pounds, and in default of payment, to imprisonment for a period not exceeding two months.

A.

TRANSVAAL DEPARTMENT OF AGRICULTURE.
DIVISION OF BRANDS.

To the Registrar of Brands, Pretoria.

I hereby certify that the Diagram shown at the foot hereof is a true copy of my Brand

....Signature.

....Address.

Date ....

Diagram of Brand.

Directions.

Place the Branding Iron on the form and trace all round with pencil, then ink the tracing over.

[To be returned without delay.

B.

BUTCHER'S FORM.

No. of Stock Bought.	Description	Registered Brand.	Other Brands and Earmarks.	Name and Address of Seller.	No. Killed or Sold.	No. on Hand.	Date.

C.

AUCTIONEER'S FORM.

Description of Stock.	Registered Brand.	Other Brands and Earmarks.	Name and Address of Seller.	Name and Address of Buyer.	Date.

GOVERNMENT NOTICE No. 515 OF 1907.

It is hereby notified for general information that the undermentioned brands have been duly allotted and registered under the Great Stock Brands Ordinance (Ordinance No. 15 of 1904) during the quarter ending 31st March, 1907.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture,
Pretoria, 25th April, 1907

No. of Brand.	Name of Owner.	Address	District.	Brand.
490	Taylor, George Henry	P O Nooitgedacht	Ermelo	ETO
491	Yeatman, Rupert	Eikeboom, P O. Middelburg	Middelburg	GY1
492	Bush, James	Eikeboom, P O Middelburg	"	GB1
493	Antill, Alfred William Samuel	Silverton, P O Box 945, Pretoria	Pretoria	AA3
494	Codrington, Sir William	Kromdraai No 76, Box 87, Standerton	Standerton	SON
495	Hoven, van der, Jacobus Esias	Honingkrans, P O Balmoral	Middelburg	GOE
496	Hoven van der Charles Fredk	Honingkrans, P O Balmoral	"	GC3
497	Madi, Petrus	Kaffirkraalkoppies Box 52, Standerton	Standerton	SM7
498	Rykaart, Marthinus Cornelius	Palmietfontein 280, Rykarts Post Palmietfontein	Potchefstroom	PR3
499	Visser Henning Johannes	Palmietfontein 280, Rykarts Post Palmietfontein	"	PV0
500	Koch, de, Michiel Johannes	Buffelsvlei 646, Rykarts Post, Palmiettontein	"	PK3
501	Meyer, Hendrik Willem Johannes	Klipfontein Rykarts Post, Palmietfontein	,	PH4
502	Johnsen, Ole	Buffelsvallei 646, Rykarts Post, Palmietfontein	,	PJ0
503	Koch, de, Kenne Nicolaas	Buffelsvallei 646, Rykarts Post, Palmietfontein		PK2
504	Keet, Gysbert Jacobus	Mahemsvallei 539 Rykarts Post, Palmiettontein	"	PK0
505	Plooy du, Fredrik Simon	Palmietfontein 280, Rykarts Post, Palmietfontein	"	PF3
506	Bennett, Philip	Hex River, P O Greylingstad	Heidelberg	H5B
507	Zerbst, Johann Albertus	Witbankplaat, P O Amersfoort	Wakkerstroom	UZ0
508	Lotz Albertus Bernardus	Witbankplaat, P O Amersfoort	,	U7A
509	Penn Francis Charles	P O Box 13, Lichtenburg	Lichtenburg	L1P
510	Cochrane, John	Modderfontein G M Co, P O Benoni, and Zonderfont, P.O Bronkhorstspruit	Pretoria	AY1
511	Wyk, van, Arie Willem	van Wyk's Vlei, P O Belfast	Carolina	CA2
512	Basson, Willem Johannes	Nooitgedacht 100 P O Devon, *via* Springs	Heidelberg	H1B
513	Fronx, Hermanus Theodorus Lourentius	Middelburg, P O Middelburg	Middelburg	G1H
514	Miller, John Edmund, and Miller, Charles Alfred	Zendelingsfontein, P O Kareepan	Bloemhof	BOM
515	Head, Bernard	Kingston Farm, Bloemhof, P O Bloemhof	"	BOH
516	Ben Moss & Co (Moss, Ben, and Cohen, Alfred)	Balmoral, P O Balmoral	Middelburg	G0M
517	Viljoen, Johannes Jacobus	Boschmanskraal, P O Bosmanspan	"	GV7
518	Joubert, Johannes Phillipus	Hartebeestspruit, P O Brugspruit	"	G5J
519	Stone, Gert Hendrik	Goedvertrouw, P O Balmoral	"	GS1
520	Stone, Andries Johannes	Goedvertrouw, P.O. Balmoral	"	G1A
521	Dyk, van, Frans Johannes	Hartebeestfontein, P O. Balmoral	"	GF3

No. of Brand.	Name of Owner.	Address.	District.	Brand.
522	Blaas, Adriaan	Balmoral, P.O. Balmoral	Middelburg	GB2
523	Slade, Clifford	Balmoral, P.O Balmoral	"	G1S
524	Volschenck, Christoffel Hendrik	Zandrift, P.O. Tautesberg (c/o S.A.C.)	"	GV2
525	Silverthorne, Charles Edwin	Witbank, P.O Witbank	"	G3S
526	Kingwill, Price	C/o C Maggs, Potgietersrust	"	W7K
527	Rosenberg Bros. (Rosenberg, Morris, & Rosenberg, Fisser)	P.O. Box 115, Randfontein	Krugersdorp	K2R
528	Barrett, William Waite	62, du Toit Street, Box 1235, Pretoria	Pretoria	AB7
529	Coghlan, John	Damesfontein 198, P.O Umtulwana	Ermelo	E0C
530	James, Charles William	Hadfield, Box 858, Pretoria	Pretoria	AJ6
531	Rogers, Dr. William Gasterson	Kareebosch 88, Standerton, and 29 Klein Street, Hillbrow, Johannesburg	Standerton	SR2
532	Bell, Henry	Rietpan 83, Lichtenburg, and Box 1024, Johannesburg	Lichtenburg	L2H
533	Merwe, van der, Pieter Jacobus	Krans van Blesbokspruit, Mooifontein, P O Box 74, Bethal	Bethal	TP3
534	Buchanan, Harry William	Wyntown, P O The Brook, via Lake Chrissie	Ermelo	E0B
535	Merwe, van der, Wouter Jacobus	86, Ockerse Street, P O Box 216, Krugersdorp	Krugersdorp	KM3
536	Rickert, Daniel Jacobus	Klipdrift, P.O. Rhenosterkop	Pretoria	A2R
537	Villiers, de, Maria Fredrika	Erf 261, Gezina, Box 489, Pretoria	"	A0V
538	Paxton, Thomas	New Modderfontein G M Co, Box 25, Benoni	Witwatersrand	X1P
539	Patten, Charles Frederick	Driehoek 45, Bethal, P O Box 48, Bethal	Bethal	I1P
540	Carpenter, Harold James	Worthing 2375 via Pienaars River	Waterberg	W0R
541	Molotsane, Piet	Droogelaagte No 1800 c/o Sub-Native Comm, Warm Baths	"	W1M
542	Armstrong, Robert Maclachlan	Vaalwater No 5, Zandriviersspoort	"	W7A
543	Preez, du, Andries Johannes Stephanus	Witbank, P O Box 68, Heidelberg	Heidelberg	H1D
544	Becker, Johannes Cornelis Frederik	P O Heidelberg	"	HB0
545	Blinkpoort Pound	Blinkpoort, P O Fortuna	"	◊ H0
546	Landsn (senior), Charles	Jonkersdam No 103, Box 4, Standerton	Standerton	S0L
547	Schepmann, John Heinrich	Bersta, P O Bethanie	Rustenburg	RS2
548	Judd, George Bowen	Geduld, Boksburg District, P O Box 36, Springs	Witwatersrand	X7J
549	Louw, David Abraham	Farm Leeuwspruit 195 P.O. Platrand	Standerton	S2L
550	Lindenburg, Hermann	P.O. Zandelingsfontein	Wolmaransstad	V0L
551	Pitt, Edward Percy	Retief Street, P.O. Box 35, Potchefstroom	Potchefstroom	PP3
552	Cramer, Susette	Mooibank Settlements, P O. Mooibank	"	PC7
553	Rocher (junior), Charles Guillaume Cornelle	Rietfontein 503, P O Potchefstroom	"	PZ4
554	Swanepoel, Francois Johannes	P.O. Ventersdorp	"	PS7
555	Noel, Eugene (Revd.)	Vleeschfontein 207 Bushveld	Marico	MA1
556	Booth, Thomas, and Bell, Rowland Charles	Spioenkop 177, P.O. Lake Chrissie	Ermelo	EX7
557	Gunthorpe, James, and Lundy, Robert William	Bellevue "B" 176, P.O. Lake Chrissie	"	E0G

No. of Brand.	Name of Owner.	Address.	District.	Brand.
558	Opperman, Philippus Albertus	Driefontein 180, P.O. Trichardtsfontein	Bethal	TPO
559	Otterfontein Pound	Klerksdorp Sub-District, P.O. Klerksdorp	Potchefstroom	♦ P9
560	Buchanan, Dorlen Thomas	Goede Hoop 362, P.O. Spelonken	Zoutpansberg	Z3B
561	Heimaan (Mrs.), David	P.O. Hartebeestfontein 624	Potchefstroom	PH6
562	Campbell, James	Dwars-in-den-Weg 238, P.O. Standerton	Standerton	SOC
563	The Krugersdorp Cash Butchery and Bakery Co.	P.O. Box 62, Krugersdorp	Krugersdorp	KC2
564	Ackerman, Andries Hendrik	Witpoort, Boksburg District, P.O. Boksburg	Witwatersrand	XA3
565	Pincus, Isaac	Klipriviersburg Estate, Box 1821, Johannesburg	Johannesburg	J1P
566	Bean, Frances Afca	Orlando Park, Box 22, Christiana	Bloemhof	B2B
567	Macfarlane, William Campbell	Zetland, P.O. Schweizer Reneke	Wolmaransstad	VM1
568	Wronsky, Ludwig	Rhenosterput 108, P.O. Korannafontein	Lichtenburg	LOW
569	Simpson, Percy Edward	P.O. Box 87, Pietersburg, Districts Marabastad and Haenertsburg	Zoutpansberg	Z8O
570	Coetzee, Ockert Jacobus	Belfast	Lydenburg	YC1
571	Coetzee, Johannes Lodewicus	Hartebeestspruit, Belfast	"	YC2
572	Coetzee (C.'s son), Cornelius Jacobus	Hartebeestspruit, Belfast	"	Y1C
573	Maré, Karel Petrus	Groenvlei, Belfast	"	YK2
574	Mills, Willem Georg	Elandslaagte, Belfast	"	YM1
575	Simpson, Frederick William (senior and junior)	P.O. Box 36, Belfast	"	YS1
576	Grobler, Willem Jacobus	Hartebeestfontein	"	YG3
577	Minnaar, Cornelius Jacobus	Groenvlei, Belfast	"	Y2M
578	Matthee, Matys Johannes	Belfast	"	Y1M
579	Thomas, Charles Henry	P.O. Box 20, Belfast	"	YT1
580	Young, Percival J., and Bates, Fred	Rietvlei, Belfast	"	YB1
581	Joubert, Marthinus Godfried	Farrafontein, P.O. Machadodorp	"	Y7J
582	Joubert, Jacob Johannes	Witboom, P.O. Witpoort, Belfast	"	Y1J
583	Lewis, George	Steepsplaats, P.O. Box 45, Belfast	"	Y7L
584	Bapsfontein Pound	P.O. Bapsfontein	Pretoria	♦ A6
585	Wollings, Alfred	Moorbank Settlements, P.O. Moorbank	Potchefstroom	POW
586	Wonderboom Pound	Erf 311, South, c/o Dist. Commandant, S.A.C., Pretoria	Pretoria	♦ A5

BRANDS SURRENDERED AND CANCELLED IN TERMS OF SECTION 13 OF THE GREAT STOCK BRANDS ORDINANCE OF 1904.

No. of Brand	Name of Owner.	Address.	District.	Brand.
593	Grootpan Pound	Grootpan, Val Station	Standerton	♦ S3
129/06	Kromdraai Pound	Kromdraai, P.O. Witbank	Middelburg	♦ G2
133/06	Zuurfontein Pound	P.O. Zuurfontein	Pretoria	♦ A6
257/06	Goudkoppies Pound	Goudkoppies Railway Station, Nancefield	Krugersdorp	♦ K5

TRANSVAAL METEOROLOGICAL DEPARTMENT.

RAINFALL RETURNS FOR THE MONTHS OF FEBRUARY, MARCH AND APRIL, 1907.

NOTE.—The rainy season is measured from 1st July in one year to the 30th June in the next.

FEBRUARY, 1907.

District.	Place.	Month. Feb., 1907. Ins.	Days.	Season. From 1st July, 1906. Ins.	Days.
Barberton	Barberton	7·27	13	29·21	72
	Komati Poort	9·00	15	38·89	66
Bloemhof	Bloemhof	2·81	11	15·73	58
Carolina	Machadodorp .. .	5·34	15	29·68	85
Ermelo	Ermelo	6·96	7	30·88	72
Heidelberg ..	Heidelberg	7·18	11	25·30	59
	Vereeniging	8·54	11	23·03	65
Lichtenburg .. .	Lichtenburg ..	4·95	10	19·62	59
Lydenburg .. .	Belfast	5·31	13	29·65	83
	Pilgrims Rest	14·63	22	35·96	102
Marico	Zeerust	5·36	8	25·06	54
Middelburg .	Middelburg	5·43	10	32·08	83
Potchefstroom .. .	Potchefstroom .. .	6·48	10	22·43	59
	Klerksdorp	8·06	12	25·34	63
Pretoria	Arcadia, Pretoria	5·64	12	28·98	73
	Govt. Buildings, Pretoria .	5·88	11	26·14	64
	Modderfontein .. .	9·61	14	29·60	70
Rustenburg	Rustenburg	7·56	8	27·88	59
Standerton ..	Standerton	6·41	13	26·22	63
Swaziland ..	Mbabane	9·95	16	41·37	93
Wakkerstroom ..	Wakkerstroom	5·35	10	26·41	63
	Volksrust	10·18	15	40·97	83
Waterberg .	Potgietersrust	4·60	12	34·48	68
	Nylstroom	5·46	12	29·06	57
Witwatersrand	Joubert Park, Johannesburg	7·65	14	31·97	62
	Zuurbekom	5·53	14	21·17	74
	Krugersdorp..	7·30	13	19·28	60
Wolmaransstad .. .	Wolmaransstad	5·44	9	17·38	52
Zoutpansberg ..	Pietersburg	6·29	12	26·84	56

SUMMARY.—During the first week of the month a severe rainstorm passed over the Colony causing floods, damage, and some loss of life. The remainder of the month was generally genial and warm with frequent light rains, but in some places very heavy showers were again experienced. The rainfall, both for the month and the season, is much above the average of the last few years, and is probably only equalled in recent years by that of the wet season of 1893.

OBSERVERS' WEATHER REPORTS FOR FEBRUARY, 1907.

BARBERTON DISTRICT.—

Cairn Siding.—Very heavy rains fell during the month and the river rose to a great height, the highest since 1894. The total rainfall, 16·24 inches, speaks for itself. A lot of damage has been caused by the floods.—(T. S. Watkinson.)

BLOEMHOF DISTRICT.—

Bloemhof.—Even temperature; good rains; warm weather; light winds and calms.—(C. C. Campbell.)

CAROLINA DISTRICT.—

Carolina.—The first week was an exceptionally wet one. Rivers were impassable and the postal service was completely disorganised. Much damage has been caused to crops and lands close to river, banks having been swept away completely. Subsequent to the 7th, no rains of any importance have fallen, although some very heavy storms passed to the E. and S. of the town, followed by heavy showers.—(S. J. van Wyk.)

ERMELO DISTRICT.—

Experimental Farm.—Very heavy rains in the beginning of the month.—(H. Nicholson.)

Ermelo (*b*).—The weather during February has been unusually hot; rain fell on seven days, but too heavy to benefit the country. Rivers have been in flood, and crops have suffered as well as roads from the immense quantities of water.—(Mrs. S. M. Nicolson)

MIDDELBURG DISTRICT.—

Middelburg.—Exceptionally heavy rains fell at the beginning of the month, the rivers and streams rising to the maximum height of the year. The Little Oliphant's River, below the town, rose to the mark of the highest known flood. All low-lying crops have been ruined, those on the high ground being exceptionally good. Fruit, generally, has this year reached exceptional sizes. Since the first week, no rain to speak of has fallen: the grass has begun to take on its winter hues and the trees to take on their autumnal tints and to lose their leaves.—(Dr. H. A. Spencer.)

POTCHEFSTROOM DISTRICT.—

Elands Heuvel.—Very hot and trying month, although the temperature was comparatively low throughout: very heavy dews at night.—(M. Cruickshank.)

Klerksdorp.—On the 3rd, light rain continued nearly all day; on the 4th, continuous heavy rain fell all day, very little thunder or lightning and very little wind, but in the evening a strong E. wind sprang up. At about 5 a.m. on the 5th, the Schoonspruit came down and by about 8 a.m. rose to within three feet of the highest known water mark, submerging the bridge and embankment upon which the road runs between the old and new towns. The flat was under water for two days, when the river fell to its normal channel. The total rainfall of the month has been much above the average, and the seasonal rainfall is already four inches higher than any season within the last ten years. The veld and crops are in splendid condition.—(H. M. Guest.)

Potchefstroom.—Light winds towards end of month, and generally hot and close; threatening rain.—(F. Glen Leary.)

Ventersdorp.—Good rains fell during the month—total, 4·42 ins.; the weather has been fairly warm all through.—(W. H. Warden, S.A.C.)

PRETORIA DISTRICT.—

Roberts Heights.—Plenty of rain fell at the beginning of the month, mostly light, which did a lot of good. Nights getting cold towards end of month, and it seems as though winter is going to set in early. There has been a remarkable absence of thunderstorms during the month as compared with former Februaries. Highest temperature in the shade recorded was 84°·0, while the lowest was 41°·0; lowest temperature on the grass was 35°·5.—(Pte. F. P. Hughes, R.A.M.C.)

Sunnyside.—The rainfall for this month was about the average, but nearly all of it fell between the 3rd and 6th, when there were floods all over the country. The month, taken as a whole, has been warm and a good deal of cloud has been present on almost every day.—(Hon. J. R. Stopford.)

WATERBERG DISTRICT.—

Nylstroom.—Genial weather; several thunderstorms during month; thick fog in the early morning on a few days at the beginning of the month; crops fairly good and agricultural prospects promising.—(W. Collins, S.A.C.)

Potgietersrust.—Genial weather throughout the month; days generally bright, rain generally falling towards sunset; a few strong winds, mostly at night; crops are looking well, the fine days helping them greatly. Rainfall has been about the average for the month.—(Lance-Corpl. C. Kendall, S.A.C.)

ZOUTPANSBERG DISTRICT.—

Woodbush Forest.—One of the wettest months I have experienced; rivers impassable most of the time, and the crops suffering from rust.—(A. K. Eastwood.)

R. T. A. INNES, *Director,*
Transvaal Meteorological Department.

Government Observatory,
Johannesburg, 5th March, 1907.

MARCH, 1907.

District.	Place.	Month. March, 1907. Ins.	Month. March, 1907. Days.	Season. From 1st July, 1906. Ins.	Season. From 1st July, 1906. Days.
Barberton	Barberton	3·33	10	32·54	82
	Komati Poort	2·76	8	41·65	74
Bethal	Bethal	2·78	4	31·80	74
Bloemhof	Bloemhof	2·57	15	18·30	73
Carolina	Caroline	3·27	7	—	—
Ermelo	Ermelo	6·06	9	36·94	81
Heidelberg	Heidelberg	1·83	7	27·13	66
	Vereeniging	2·63	8	25·66	73
Lichtenburg	Lichtenburg	1·06	9	20·68	68
Lydenburg	Belfast	7·00	7	35·93	76
	Pilgrims Rest . ..	6·42	22	42·38	124
Marico	Zeerust	2·01	11	27·07	65
Middelburg	Middelburg	1·20	5	33·28	88
Potchefstroom	Potchefstroom	2·00	10	26·90	61
	Klerksdorp	3 48	12	28·82	75
Pretoria	Arcadia, Pretoria	0·81	7	29·79	80
	Govt. Buildings, Pretoria .	0·43	4	26·57	68
	Modderfontein	1·59	6	31·19	76
Rustenburg	Rustenburg	0·77	6	28·60	64
Standerton	Standerton	0·36	2	26·58	65
Swaziland	Mbabane	6·86	12	48·23	105
Wakkerstroom	Volksrust	2·93	12	43·96	95
Waterberg	Nylstroom	0·84	4	29·90	61
	Potgietersrust	1·17	3	35·65	71
Witwatersrand	Joubert Park, Johannesburg	2·51	7	34·64	80
	Government Observatory .	2·87	6	31·76	82
	Krugersdorp..	3·09	9	29·67	82
	Zuurbekom	3·21	9	24·38	83
Wolmaransstad	Wolmaransstad	2·79	12	20·17	64
Zoutpansberg	The Hospital, Pietersburg .	4·51	8	30·44	73
	Louis Trichardt	2·39	14	41·62	112
	Leydsdorp	4·86	8	—	—

SUMMARY.—Whilst a few places had good rains in March, other places report almost a drought. Precipitation was bountiful over the Districts of Ermelo, Lydenburg, Swaziland and Zoutpansberg, moderate in the remaining eastern districts and over the extreme S.W. of the Colony; elsewhere the amount has been deficient, barely one inch falling over the Districts of Lichtenburg, Middelburg, Pretoria, Rustenburg, Standerton and the Waterberg. The figures for the season, thanks to the heavy rainfalls earlier, are still far above the average. A few complaints of drought have been made, but everywhere rivers and springs are still strong.

OBSERVERS' WEATHER REPORTS FOR MARCH, 1907.

BLOEMHOF DISTRICT.—

Bloemhof.—Sufficient rain; many thunderstorms with no rain: beautiful mild weather and light winds.—(C. C. Campbell.)

CAROLINA DISTRICT.—

Carolina.—Although the rainfall recorded during the past month has not been much below that of February, March may be said to have been a much drier month than February. This is accounted for by the fact that no soft continuous rains fell as in February. On the 1st, there was a heavy fall (1·58 ins.). of which 1·27 ins. was registered between 3.54 and 5.55 p.m.; while for the rest of the month the total registered amounted to only 1·69 ins., distributed over seven days. The weather underwent some change and was much cooler throughout the month. The comparatively dry weather of March, although beneficial, especially to crops, could not check the disease prevalent amongst large and small stock, which is attributed to the exceptionally wet weather experienced during the first half of February.—(S. J. van Wijk.)

ERMELO DISTRICT.—

Ermelo.—A very heavy downpour at the beginning of the month and several light showers brought the rainfall for March higher than usual; warm days, cool nights, and almost chilly mornings, are evidence that the winter will soon be with us.—(Mrs. S. M. Nicolson.)

HEIDELBERG DISTRICT.—

Heidelberg.—A very dry month for the time of year. The weather was generally warm, maximum shade temperatures of 80° and above being recorded on 19 days during the month, but nothing higher than 84·1°. The minimum thermometer shewed temperatures of less than 50° three times during the month, and the grass minimum fell below that standard on eight nights. Thunderstorms were comparatively infrequent during the month, and brought very little rain to Heidelberg itself. During the latter part of the month, the whole district suffered very severely from locusts.—(L. N. Foggin.)

Vyffontein.—Very little rain fell, but swarms of locusts which destroyed almost everything.—(A. S. Kok.)

LYDENBURG DISTRICT.—

Bushbuck Ridge (near Pilgrims Rest.)—A spell of dry weather allowed the swollen rivers to go down and traffic to be resumed; crops below the average.—(Colonel F. Steinacker.)

MIDDELBURG DISTRICT.—

Middelburg.—This month has been the hottest of the summer months, and also the driest, the mean maximum being unusually high for the month of March; rain only fell during five days of the month. The country has quite taken on its winter aspect, with bleached grass and dry dusty roads. Where there has been much verdure, there have been heavy dews during most of the month. Though there has been much threatening of storms and rain, bright still days have obtained.—(Dr. H. A. Spencer.)

POTCHEFSTROOM DISTRICT.—

Klerksdorp.—There is nothing of importance to report. A heavy hailstorm occurred on the 21st, coming from the N.E. about 6.30 p.m., but did no damage of any consequence. —(H. M. Guest.)

Ventersdorp.—Very little rain, which is badly required to revive the grass eaten by locusts, fell during the month. The first half of the month was very hot and close, but during the latter half, temperatures fell; the last week of the month was windy.—(W. H. Warden, S.A.C.)

PRETORIA DISTRICT.—

Roberts' Heigh's.—Not much rain fell during the month. There have been no heavy storms or gales. A locust swarm made its appearance from the S.W. on the 24th and continued until the 30th, all coming from the S.W, and did enormous damage to crops, etc.—(F. P. Hughes, Pte. R.A.M.C.)

Sunnyside.—Very little rain has been recorded at this station during March. Although no record has been kept of the temperature, it appears to have been unusually high for so late in the season.—(Hon. J. R. Stopford.)

RUSTENBURG DISTRICT.—

Rustenburg.—The weather has been very favourable but warm; not much rain has fallen; many more crops have been put in than last year. District looking well, and if it were not for large swarms of locusts, the farmers would have no complaints.—(Head Constable D. Allam, S.A.C.)

Wolhuterskop.—A hot dry month with deficient rainfall and surfeit of locusts.—(J. C. P. Maynard.)

SWAZILAND DISTRICT.—

Pigg's Peak.—A much finer month by day, most of the rain and mist falling during the nights.—(Dr. F. Penny.)

WAKKERSTROOM DISTRICT.—

Volksrust.—A great number of thunderstorms during the month and thick mists on several days. Strong wins from the N.W. and S.E. on many days; more sunshine than in the two previous months.—(Constable R. G. Smith, S.A.C.)

WATERBERG DISTRICT.—

Potgietersrust.—A genial month, mornings generally very bright and clouds coming up in the afternoons, rain fell on three days only in the town, but several heavy rains have been noticed falling on the surrounding mountains. Crops looking well; locusts have been seen a few miles from here but have not yet touched the village; they were travelling in a N.E. direction.—(L.-Corporal C. Kendall, S.A.C.)

ZOUTPANSBERG DISTRICT.—

Chunes Poort.—This month has been much hotter, because less clouded than the preceding month Veld getting dry again, grass fires seen nearly every day. River still runs but not nearly so strongly. Locusts are destroying crops in the neighbourhood, and are moving mainly N.—(Cyril C. Hicks)

Krabbefontein.—Good rains fell during the month, which has not been so wet as the corresponding month of previous years; the season appears to be about a month earlier this year then usual.—(C. Howard Ricketts.)

Leydsdorp.—Heavy rain fell at the beginning of the month, but very little since the 12th; the weather appears to be more settled, nights getting much cooler. Two very slight shocks (earthquake) took place in the early morning of the 8th, apparently going from N.E. to S.W.; no damage done.—(A. Chandler.)

Louis Trichardt.—A dry month, a little misty rain falling on a few days. Rivers can now be crossed, and roads are being repaired: crops are also looking better.—(P. C. Vercueil, Jnr.)

Mamathola.—The month has been wet on the whole; heavy rains in the beginning and light rains and mist towards the end; weather much cooler towards the end of the month; two heavy thunderstorms, lightning very severe.—(H. W. Molyneux.)

R. T. A. INNES, *Director,*
Transvaal Meteorological Department.

Government Observatory,
Johannesburg, 9th April, 1907.

APRIL, 1907.

District.	Place.	Month. April, 1907. Ins.	Month. April, 1907. Days.	Season. From 1st July, 1906. Ins.	Season. From 1st July, 1906. Days.
Barberton	Barberton	3·41	14	35·95	96
	Komati Poort	4·17	11	45·82	85
Bethal	Bethal	2·43	9	34·23	83
Bloemhof	Bloemhof	5·13	12	23·43	85
Carolina	Carolina	2·79	11	—	—
Ermelo	Ermelo	2·09	13	39·03	94
Heidelberg	Heidelberg	3·53	10	30·66	76
	Vereeniging	4·40	16	30·06	89
Lichtenburg	Lichtenburg	4·85	11	25·10	75
Lydenburg	Belfast	3·76	15	34·44	114
	Pilgrims Rest	4·24	18	46·62	142
Marico	Zeerust	4·57	12	31·64	77
Middelburg	Middelburg	3·42	13	36·70	101
Piet Retief	Piet Retief	3·09	9	38·59	70
Potchefstroom	Potchefstroom	5·12	9	30·02	79
	Klerksdorp	5·82	14	34·64	89
Pretoria	Arcadia, Pretoria	2·89	10	32·68	90
	Modderfontein	3·49	11	34·68	87
Rustenburg	Rustenburg	3·10	11	31·70	75
Standerton	Standerton	2·96	11	—	—
Swaziland	Mbabane	6·27	17	54·50	122
Wakkerstroom	Wakkerstroom	3·32	9	32·14	78
	Volksrust	3·83	17	47·79	112
Waterberg	Nylstroom	3·06	6	32·96	67
	Potgietersrust	1·41	8	37·30	80
Witwatersrand	Joubert Park, Johannesburg	3·39	14	38·36	95
	Govt. Observatory, „	2·91	12	34·67	94
	Krugersdorp	2·48	10	32·15	92
	Zuurbekom	3·85	11	28·23	94
Wolmaransstad	Wolmaransstad	4·92	12	25·09	76
Zoutpansberg	Pietersburg	0·90	6	33·74	75
	Louis Trichardt	4·54	12	46·16	124
	Leydsdorp	4·05	12	—	—

Summary.—The amount of rain which fell in the S.W. of the Colony established a record for April so far as our information goes; in the centre of the Colony the amount has only been exceeded, in corresponding months, thrice since 1889. The month's rainfall was well distributed over every part of the Transvaal, excepting a small region between Pietersburg and Potgietersrust, where it was light. Heavy dews were of frequent occurrence.

The total rainfall for the season is very much above the average. Water is plentiful and all the rivers flowing.

OBSERVERS' WEATHER REPORTS FOR APRIL, 1907.

Barberton District.—

Barberton.—The rains have lasted unusually far into April and there are signs of more. A year ago, the veld was brown and burnt off, while this year the prevailing colour is green and the grass not dry enough for extensive burning.—(J. B. Drake.)

BLOEMHOF DISTRICT.—

Bloemhof.—Beautiful and mild weather for the month with unusual and steady rains; light winds, principally from an eastern quarter.—(C. C. Campbell.)

CAROLINA DISTRICT.—

Carolina.—There has been a marked change in the weather during this month, making it evident that winter is approaching; in fact, during the second and fourth weeks, distinctly cold weather was experienced, although for the rest of the month, mostly fine weather prevailed. No fall of frost to speak of; the rainfall was lower than that for March.—(S. J. van Wijk.)

ERMELO DISTRICT.—

De Hoop.—A very wet month for April, giving a splendid outlook for the winter; frost in Amsterdam and Ermelo, but none here.—(Capt. C. W. Alston).

Experimental Farm.—First frost of the season occurred on the 23rd.—(H. Nicholson.)

Ermelo.—A great deal of dull, damp, cold weather prevailed the greater part of this month. No frost fell at this station to freeze water, although frosts are reported from different parts. Seasonable weather for the time of year.—(Mrs. S. M. Nicolson.)

LYDENBURG DISTRICT.—

Bushbuck Ridge.—April has been, in spite of the absence of high winds, exceptionally cold with mostly clouded skies and S. winds. The rainfall of 8·66 ins. on 15 days was a record for April. Crops in the low country are generally unsatisfactory, while much illness prevails among men and beasts.—(Colonel F. Steinacker.)

MIDDELBURG DISTRICT.—

Middelburg.—This month has been milder than usual, the average minimum temperature having been nearly 10° higher and the average maximum nearly 10° lower than usual; this is no doubt accounted for by the humidity of the air being relatively excessive for the month of April. There have been, however, a few light frosts unregistered by the minimum thermometer four feet above the ground, the lowest temperature there recorded being 37°. As to the rain, this has been excessive for the month, the summer's fall having been augmented by an addition of 3½ inches. Generally, the month has been bright and genial, hot by day and cold by night, with heavy dews very similar to the month of September in England.—(Dr. H. A. Spencer.)

POTCHEFSTROOM DISTRICT.—

Potchefstroom.—Steady rains fell during the month; weather mild with occasional cold days; bright and sunny days towards the close of the month with irregular showers of rain.—(F. Glen Leary.)

Ventersdorp.—The weather during the month has been of an unsettled nature, constituting sudden rises and falls of temperature. Good rains fell towards the end of the month and helped to bring on the grass which had been destroyed by locusts, and enabled farmers to start ploughing again. There were dews on many nights, and on 19th, 28th and 29th they measured nearly a hundredth of an inch in the gauge. Horse-sickness in the area is almost over; cold winds very prevalent during the last half of the month.—(W. H. Warden, S.A.C.)

PRETORIA DISTRICT.—

Modderfontein.—Frost very late this year, none being recorded up to end of April. Locust swarms covering the whole place.—(Gilbert F. Ayers.)

Pretoria Heights.—There has been a fair amount of rain, evenly distributed, durng the month. Fairly heavy dews have fallen on eleven nights. The winter appears to have set in, the lowest temperature on grass being 36·0° on 23rd. A locust swarm came from the S.W. on the 28th, 29th and 30th. From September, 1906, to the end of this month, 30·26 inches of rain were registered as against 17·74 inches for the corresponding months of 1905 and 1906.—(Pte. F. P. Hughes, R.A.M.C.)

Sunnyside.—Excellent rains, for so late in the season, have fallen this month and have brought on the grass which had been eaten down by locusts. Towards the end of the month, the nights were very cold and heavy dews fell; no frost has occurred as yet.—(Hon. J. R. Stopford.)

RUSTENBURG DISTRICT.—

Rustenburg.—An unusually cool and moist month for April.—(J. C. P. Maynard.)

STANDERTON DISTRICT.—

Standerton.—Nights fresh; occasional showers, and at other times heavy deposits from dew.—(F. Crook.)

WAKKERSTROOM DISTRICT.—

Volksrust.—Rainfall considerably more than previous year. A good number of S.E. winds were experienced, bringing thick mists. No frosts recorded, and on the average the weather was much warmer than the corresponding month of last year.—(Con. R. G. Smith, S.A.C.)

WATERBERG DISTRICT.—

Potgietersrust.—Very dull and damp at the beginning of the month with thick mists; latterly bright days and very cool nights.—(C. Kendall, S.A.C.)

ZOUTPANSBERG DISTRICT.—

Chunes Poort.—Early part of month was dull and wet; after the 18th generally bright. Rivers still running strongly; heavy dews every morning; grass drying up; veld fires common; swarm of locusts passed over during early part of month.—(Cyril C. Hicks.)

Krabbefontein.—Rains have continued late this season. 5·58 ins. having fallen on 14 days during the month. Nights are getting colder.—(C. H. Ricketts.)

Leydsdorp.—A very cool month; dull weather on most days.—(A. Chandler.)

Mamathola.—Heavy rains and rivers flooded at the beginning of the month, followed by light rains and mists and cold, damp weather.—(H. D. Molyneux.)

R. T. A. INNES, *Director,*
Transvaal Meteorological Department.

Government Observatory,
Johannesburg, 6th May, 1907.

PRETORIA AND JOHANNESBURG PRODUCE MARKET PRICES.

(Supplied by the Commercial Agency Co., Limited, Seed and Produce Merchants, No. 116, Vermeulen Street, Telephone No. 165, Box 784, Pretoria; and by Messrs. Hubert Morisse & Co., Produce Merchants and Commission Agents. Loveday and Frederick Streets, Box 63, Johannesburg.)

PRETORIA

Description.	*March*, 1907		*April*, 1907		*May*, 1907.	
	Lowest	Highest	Lowest.	Highest	Lowest	Highest.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Forage, per 100 bundles ...	0 16 0	1 2 6	0 12 6	1 5 0	0 10 6	1 4 0
,, ,, bale					0 5 0	0 7 6
Mealies, per bag	0 10 0	0 10 9	0 13 3	0 14 9	0 8 9	0 12 9
Kaffir Corn per bag	0 9 6	0 11 0	0 12 0	0 14 6	0 12 3	0 13 0
Oats, per bag ...	0 14 6	0 15 6	0 14 0	0 15 0	0 14 0	0 16 6
Barley, per bag ...	0 11 6	0 14 0	0 11 9	0 13 9	0 11 6	0 13 0
Green Barley, per doz bdls					0 0 9	0 1 9
Bran, per bag	0 8 0	0 10 6	0 8 0	0 10 6	0 8 3	0 13 0
Manna, per 100 bdls. ..			—		0 5 0	0 13 0
Chaff, per bale . ..	0 3 9	0 6 3	0 4 0	0 6 3	0 2 0	0 7 9
Sweet Hay, per bale ...					0 0 6	0 1 9
Green Lucerne per doz bdls	0 1 0	0 1 6	0 1 6	0 2 0	0 0 7	0 2 0
Dried Lucerne, per bale ...					0 3 6	
Potatoes, per bag ..	0 8 6	0 11 0	0 11 0	0 16 0	0 6 0	0 19 0
Sweet Potatoes, per bag ..		—	-		0 2 3	0 7 6
Onions, per bag ...	0 6 6	0 8 6	0 8 6	0 10 6	0 5 6	0 15 3
Pumpkins, per piece ...	0 0 1½	0 0 4	0 0 2	0 0 6	0 0 2	0 0 6
Oranges, per 100 ...					0 1 3	0 5 9
Lemons, per 100 . .	0 2 0	0 4 3	0 2 6	0 4 3	0 1 0	0 9 0
Naartjes, per 100 ...				—	0 1 0	0 9 0
Eggs, per doz	0 1 11	0 2 9	0 1 2	0 2 3	0 1 3	0 2 6
Fowls, per piece ..	0 1 6	0 2 9	0 1 8	0 2 6	0 1 0	0 3 1
Ducks, per piece	0 2 3	0 3 9	0 2 3	0 3 0	0 2 0	0 3 0
Geese, per piece					0 7 9	—
Turkeys, per piece ...	0 6 0	0 13 6	0 7 6	0 15 6	0 4 0	0 12 0
Tobacco, per roll	0 0 8	0 1 3	0 0 3	0 1 6		
,, cut, per lb. ...	0 0 3	0 0 5	0 0 4	0 0 8	—	—
Pigs, per piece	0 6 0	4 2 6	0 5 0	3 10 0	0 7 6	2 14 0
Wood, per load ..	1 0 0	2 15 0	0 15 0	3 12 6	0 10 0	3 2 6
Butter, per lb.	0 1 6	0 1 9		0 1 9	0 1 3	0 2 0
Bedding, per bale	-		-	—	0 0 3	0 1 0

STANDERTON DISTRICT.—

Standerton.—Nights fresh; occasional showers, and at other times heavy deposits from dew.—(F. Crook.)

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R. T. A. INNES, *Director.*
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PRETORIA.

Description.	*March*, 1907.		*April*, 1907.		*May*, 1907.	
	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Forage, per 100 bundles ...	0 16 0	1 2 6	0 12 6	1 5 0	0 10 6	1 4 0
„ „ bale				–	0 5 0	0 7 6
Mealies, per bag	0 10 0	0 10 9	0 13 3	0 14 9	0 8 9	0 12 9
Kaffir Corn, per bag	0 9 6	0 11 0	0 12 0	0 14 6	0 12 3	0 13 0
Oats, per bag ...	0 11 6	0 15 6	0 14 0	0 15 0	0 14 0	0 16 6
Barley, per bag	0 11 6	0 14 0	0 11 9	0 13 9	0 11 6	0 13 0
Green Barley, per doz. bdls.					0 0 9	0 1 9
Bran, per bag	0 8 0	0 10 6	0 8 0	0 10 6	0 8 3	0 13 0
Manna, per 100 bdls. ...					0 5 0	0 13 0
Chaff, per bale	0 3 9	0 6 3	0 4 0	0 6 3	0 2 0	0 7 9
Sweet Hay, per bale ...					0 0 6	0 1 9
Green Lucerne, per doz. bdls.	0 1 0	0 1 6	0 1 6	0 2 0	0 0 7	0 2 0
Dried Lucerne, per bale ...					0 3 6	
Potatoes, per bag ...	0 8 6	0 11 0	0 11 0	0 16 0	0 6 0	0 19 0
Sweet Potatoes, per bag ...		—		—	0 2 3	0 7 6
Onions, per bag ...	0 6 6	0 8 6	0 8 6	0 10 6	0 5 6	0 15 3
Pumpkins, per piece ...	0 0 1½	0 0 4	0 0 2	0 0 6	0 0 2	0 0 6
Oranges, per 100 ...			-	-	0 1 5	0 5 9
Lemons, per 100	0 2 0	0 4 3	0 2 6	0 4 3	0 1 0	0 9 0
Naartjes, per 100 ...				—	0 1 0	0 9 0
Eggs, per doz.	0 1 11	0 2 9	0 1 2	0 2 3	0 1 3	0 2 6
Fowls, per piece ...	0 1 6	0 2 9	0 1 8	0 2 6	0 1 0	0 3 1
Ducks, per piece	0 2 3	0 3 9	0 2 3	0 3 0	0 2 0	0 3 0
Geese, per piece	-		-		0 7 9	—
Turkeys, per piece ...	0 6 0	0 13 6	0 7 6	0 15 6	0 1 0	0 12 0
Tobacco, per roll	0 0 8	0 1 3	0 0 3	0 1 6		
„ cut, per lb. ...	0 0 3	0 0 5	0 0 4	0 0 8	—	-
Pigs, per piece	0 6 0	4 2 6	0 5 0	3 10 0	0 7 6	2 14 0
Wood, per load ...	1 0 0	2 15 0	0 15 0	3 12 6	0 10 0	3 2 6
Butter, per lb.	0 1 6	0 1 9		0 1 9	0 1 3	0 2 0
Bedding, per bale	-		-	-	0 0 3	0 1 0

JOHANNESBURG.

Description.	*March*, 1907.						*April*, 1907.						*May*, 1907.					
	Lowest.			Highest.			Lowest.			Highest.			Lowest.			Highest.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Barley, per 163 lbs. ...	0	11	0	0	14	0	0	9	0	0	14	0	0	7	6	0	11	0
Bran, per 100 lbs (Colonial)	0	7	6	0	7	9	0	7	6	0	8	0	0	7	9	0	9	0
Chaff, best, per 100 lbs. ..	0	3	9	0	6	0	0	4	0	0	5	9	0	4	6	0	5	9
„ medium „ ...	0	3	0	0	3	6	0	3	0	0	3	6	0	3	0	0	3	6
Eggs, per doz. (Colonial) ...	0	1	9	0	1	11	0	1	4	0	1	9	0	1	3	0	1	8
Salt, per bag	0	5	0	0	6	0	0	5	0	0	6	0	0	5	6	0	6	6
Forage, (Transvaal) ...	0	6	3	0	7	3	0	6	9	0	8	3	0	6	9	0	8	0
„ (Col'nal) best per 100lbs	0	7	0	0	7	3	0	7	0	0	8	3	0	7	0	0	8	0
„ „ med „	0	4	8	0	6	6	0	4	9	0	6	9	0	4	9	0	6	9
S. Meal, good	1	2	0	1	4	0	1	3	0	1	4	6	1	3	0	1	4	6
Rye	0	12	6	1	0	3	0	12	6	0	16	6	0	12	6	0	16	6
Wheat ...	0	18	0	1	1	6	0	19	0	1	2	9	1	1	6	1	2	9
Mealies, Hickory King Whites	0	10	6	0	12	0	0	11	9	0	13	9	0	9	0	0	11	9
„ (O.R.C.) Whites ...	0	9	3	0	11	0	0	10	6	0	13	0	0	9	0	0	11	6
„ Yellow	0	9	0	0	11	0	0	10	3	0	12	3	0	9	0	0	10	0
Kaffir Corn, per 203 lbs ...	0	8	0	0	11	9	0	10	6	0	13	0	0	9	9	0	12	9
Hay, sweet (Transvaal) ...	0	0	8	0	1	8	0	1	4	0	1	10	0	1	1	0	1	9
Lucerne, per 100 lbs ...	0	4	0	0	6	6	0	5	0	0	6	6	0	5	3	0	6	6
Oats (Colonial) per 150 lbs	0	9	0	0	14	6												
„ per 133 lbs ..	0	7	0	0	11	9	0	9	0	0	13	6	0	9	0	0	14	6
Potatoes, best, per 163 lbs, new	0	8	6	0	12	0	0	11	0	0	17	0	0	9	0	0	15	0
„ med. „ ..	0	4	0	0	8	0	0	7	6	0	13	6	0	5	6	0	13	0
„ inferior „ ...	0	2	0		—		0	4	0	0	10	0	0	4	0	0	8	0
Onions, good, per 125 lbs.	[illegible]	6	0	0	11	0	0	8	6	0	11	0	0	7	6	0	9	0
Pigs, live weight, per lb ...	0	0	3½	0	0	4½	0	0	2½	0	0	4	0	0	3	0	0	4
Turkeys, cocks ...	0	7	0	0	11	0	0	4	0	0	10	0	0	4	0	0	10	0
„ hens ...	0	4	0	0	6	0	0	3	6	0	6	0	0	3	6	0	4	6
Fowls	0	1	6	0	3	0	0	1	6	0	3	0	0	1	6	0	3	0
Ducks ...	0	1	9	0	2	9	0	2	0	0	2	9	0	2	0	0	2	9
Geese	0	5	0	0	7	0	0	5	6	0	6	0	0	5	6	0	6	0
Pigeons	0	0	10	0	1	0	0	0	10	0	1	0	0	0	10	0	1	0
Bedding, per bale	0	0	6	0	1	0	0	1	0	0	1	2	0	0	6	0	1	2
Grass, per bale	0	1	0	0	1	2	0	1	0	0	1	8	0	1	0	0	1	2
Butter (O.R.C.), per lb. ...	0	0	6	0	1	0	0	0	6	0	1	2	0	0	10	0	1	2
Pumpkins, per 100 lbs. ...	0	2	0	0	2	6	0	1	9	0	2	6	0	1	9	0	2	0
Beans, sound, per 200 lbs...	0	19	6	2	5	0	0	19	6	2	5	0	0	17	0	2	7	0

(64)